



Danmarks
Nationalbank

Monetary Policy
in Denmark



3rd edition

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Foreword

Danmarks Nationalbank is the Danish central bank. The legal basis for its operations is the Danmarks Nationalbank Act of 1936, which stipulates that Danmarks Nationalbank must maintain a safe and secure currency system and facilitate and regulate the traffic in money and the extension of credit. One of Danmarks Nationalbank's overall objectives is to contribute to price stability, i.e. low inflation. This is done by conducting monetary policy with the objective of keeping the krone stable vis-à-vis the euro.

A revised 3rd edition of the publication "Monetary Policy in Denmark" is now available. Like the previous editions, it aims to give interested readers a comprehensive, updated account of the Danish approach to monetary policy and the relationship between monetary policy theory and practice.

The publication is structured as follows: Chapter 1 introduces the overall strategy for Denmark's monetary policy seen in relation to those of other countries. Chapter 2 presents the instruments used by Danmarks Nationalbank to manage short-term interest rates. Chapter 3 gives an account of Denmark's fixed-exchange-rate policy against the euro and the Danish foreign-exchange market, while Chapter 4 looks at the money market. Finally, Chapter 5 describes how fluctuations in interest and exchange rates impact on the Danish economy.

CHAPTER 1

The Monetary-Policy Strategy

SUMMARY

The monetary-policy strategy is the link between monetary-policy instruments and objectives. In most countries, the primary objective of monetary policy is to maintain price stability, which is generally taken to mean low inflation. Central banks pursue this objective in different ways. Denmark has conducted a fixed-exchange-rate policy since the early 1980s, while several other small countries have opted for regimes based on explicit inflation targets since the early 1990s. Irrespective of the strategy chosen, the short-term interest rate is the primary instrument used in monetary policy.

Due to the fixed-exchange-rate policy, the Danish monetary policy is aimed at keeping the krone stable against the euro. The main objective of monetary policy in the euro area is to maintain an inflation rate of below, but close to, 2 per cent. Keeping the krone stable against the euro provides a framework for low inflation in Denmark in the slightly longer term.

Sustainable fiscal policy and a clear distribution of responsibilities in relation to economic policy make it easier for a central bank to meet its objectives. In Denmark, this distribution of responsibilities has been specified clearly: monetary and exchange-rate policies are aimed at keeping the krone stable vis-à-vis the euro, while any specific need to stabilise cyclical fluctuations in Denmark is handled via fiscal policy or other economic policies.

Successful monetary policy, whereby inflation expectations are kept at a low and stable level, requires a credible central bank that is independent of the political system in its implementation of monetary policy. Moreover, openness in relation to the monetary-policy strategy is essential. This ensures that others are able to understand the monetary-policy decisions made and trust that the central bank is able and determined to pursue the strategy announced.

It is difficult to say which monetary-policy strategy is generally most expedient when it comes to maintaining price stability and a favourable employment situation. In Denmark's case the fixed-exchange-rate policy – supported by stability-oriented fiscal policies – has created a credible

framework for stable economic development. Other countries have had success with other strategies.

1.1 WHY PRICE STABILITY?

The primary objective of monetary policy is to maintain stable prices, which is taken to mean low inflation.

The reason for having price stability as the primary objective is that nowadays there is consensus that monetary policy does not have any positive impact on the real economy in the long term; it can only affect inflation. According to the traditional Phillips curve theory, it is possible permanently to reduce unemployment to below its natural level by conducting expansionary economic policy. This comes at a cost: higher inflation. However, this theory has proved not to hold true. Experience from the 1970s and early 1980s shows that attempts to exploit this correlation eventually lead to higher inflation without any improvement in the real economy – on the contrary. The higher prices, as well as the increased employment and production, resulting from the expansionary policy will gradually raise inflation expectations and lead to corresponding wage increases. This reduces the level of competitiveness in the sectors competing with abroad, entailing loss of market shares and jobs. Employment will therefore fall back to the baseline, and the ultimate result will simply be higher prices and wages, not lower unemployment, cf. Storgaard (2009).

In view of the negative effects of inflation, monetary policy can therefore best contribute to welfare by supporting a steady "nominal anchor" for the economy as a foundation for low and stable inflation expectations.

In economic literature, a number of arguments have been put forward for pursuing monetary policy aimed at keeping prices stable, cf. Gaspar et al. (2001):

- High inflation often goes hand in hand with fluctuating inflation rates, which masks the development in relative prices. This hampers the savings and investment decisions of households and corporations, with a risk of inexpedient allocation of resources in the economy.
- Fluctuating inflation rates prompt creditors to add a risk premium to the rate of interest to compensate for the uncertainty about the future level of inflation. All other things being equal, this leads to higher nominal interest rates, which may impede investment and economic growth.
- In an inflationary environment, corporations and households use a disproportionate amount of resources on safeguarding themselves

against future inflation when concluding contracts in the markets for goods and labour and in the financial markets.

- High and fluctuating inflation leads to a redistribution of wealth among debtors and creditors that has no real-economic foundation.
- Inflation may lead to distortions in a nominally based tax system so that the real yield on investments after tax depends on the rate of inflation and does not simply reflect the productive yield on the investments.

Generally, the monetary-policy objective of price stability is interpreted as an inflation rate of a couple of per cent rather than zero. This is attributable to real economic considerations, as well as more technical aspects.

As far as the real economy is concerned, nominal wages often display downward rigidity. Consequently, it may be easier to create scope for required adjustments of real wages between companies and sectors and in the economy as a whole if inflation is slightly positive, cf. Akerlof et al. (1996). Likewise, some measure of positive inflation may facilitate adjustment of relative prices of goods and services.

As regards the technical aspects, experience shows that using the consumer price index as an indication of inflation trends may involve measurement problems. For example, quality improvements resulting from the introduction of new products – such as upgraded computers – may not be included, and therefore inflation tends to be overestimated, cf. Boskin et al. (1998).

Deflation is the term used about a sustained fall in the general level of prices. Deflation of a certain magnitude involves disadvantages that are more or less comparable to the above disadvantages of high inflation. In addition, deflation makes it difficult for the central bank to use the interest-rate instrument, as the lower threshold for nominal interest rates is zero per cent, cf. Coenen (2003). In other words, there is a limit to how low real interest rates can be, and there is a risk of a downward spiral whereby a depression is prolonged as a result of the households and the corporate sector postponing their consumption and investment decisions. In a situation where the capital base of the banking sector is weak and the households and the corporate sector have high debt ratios, a deflation-induced increase in real debt burdens may also lead to losses in the banking sector to an extent that may threaten financial stability, cf. Bernanke (2003).

Interest rates are the instrument used by central banks to pursue the objective of price stability. If the central bank raises its monetary-policy interest rates, this will, all other things being equal, dampen inflationary

pressures in the economy. When interest rates rise, it becomes more expensive to borrow to finance consumption, leading to a tendency to save up rather than consume. In addition, higher interest rates normally lead to a reduction in the cash prices of real property, which dampens housing investment and curtails the households' wealth and consumption. The higher interest rates also reduce corporate investment since loans become more expensive and passive investment yields higher returns. Lower consumption and investment lead to lower activity and employment in the economy. This increases unemployment, which in turn dampens wage developments, leading to downward pressure on the rate of inflation and inflation expectations.

Conversely, interest-rate cuts stimulate consumption, investment, activity and employment. This reduces unemployment and exerts upward pressure on wages and prices. The process whereby a change in interest rates ripples through the economy, ultimately affecting inflation, is known as the monetary-policy transmission mechanism, cf. Chapter 5.

Normally central banks focus on inflation and inflation expectations in the medium term, rather than current inflation, since monetary policy can only affect price developments with a certain delay, which may vary over time. In economic literature, this is referred to as relatively long and variable time lags in the monetary-policy transmission mechanism, cf. Angeloni et al. (2003). As a result, monetary policy must be forward-oriented.

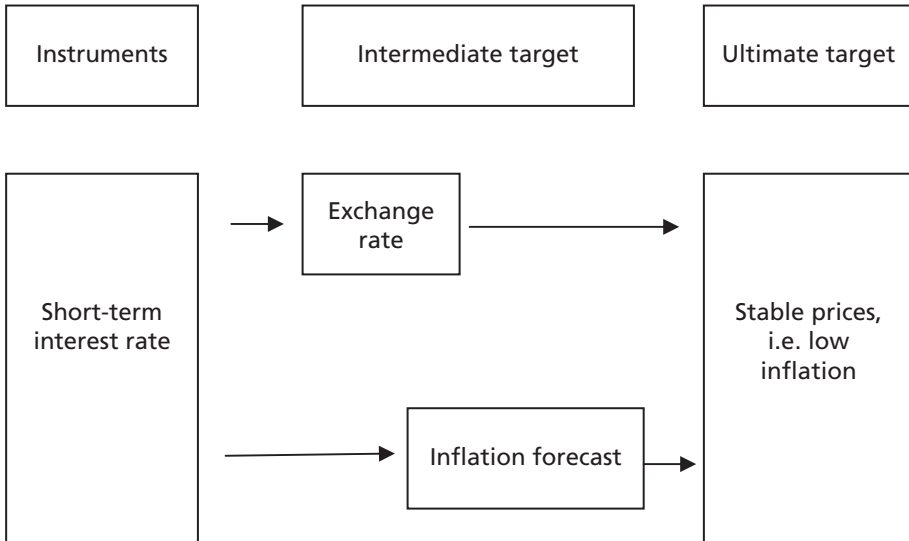
1.2 DIFFERENT MONETARY-POLICY STRATEGIES

Although there is a high degree of consensus in terms of monetary-policy objectives and instruments, central banks still have different approaches, cf. Abildgren and Thomsen (2008).

Since 1990, several central banks – including those of the UK, Sweden, Norway, Australia and New Zealand – have introduced inflation target regimes, cf. Chart 1.1. Their monetary policies are based on explicit quantitative targets for the expected course of inflation in the medium term (e.g. 2-3 years) that have been laid down by the relevant central bank or government. The precise target varies from country to country. For example, the Bank of England operates with an inflation target of 2 per cent that has been laid down by the government, while Sveriges Riksbank's inflation target is 2 per cent +/- 1 per cent. These central banks strive to meet the inflation target by adjusting their interest-rate policies. If inflation is set to exceed the target, the central bank seeks to dampen price developments by raising its monetary-policy interest rates – and vice versa when inflation is on the low side of the target.

ILLUSTRATION OF MONETARY-POLICY TARGETS AND INSTRUMENTS

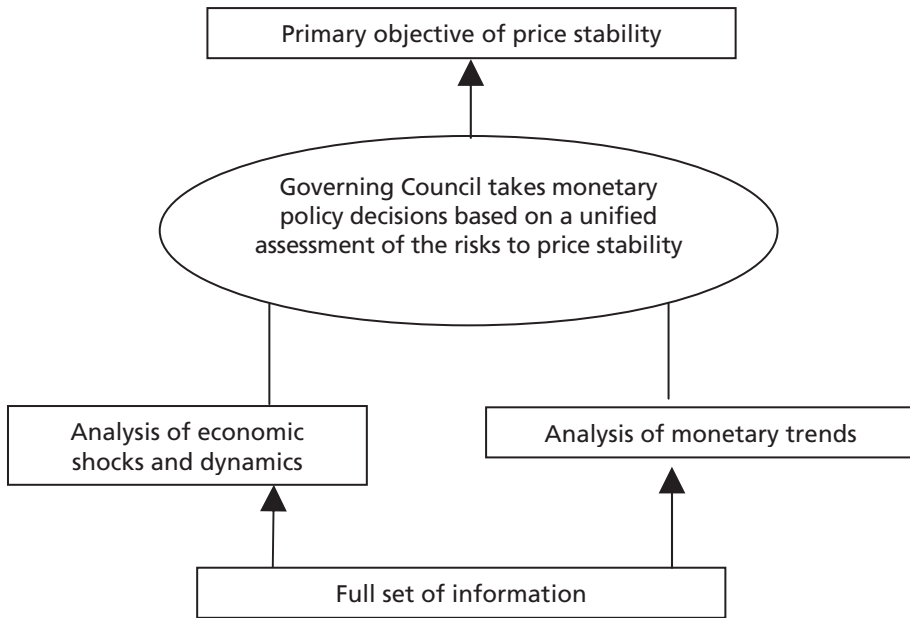
Chart 1.1



Note: Today, the vast majority of central banks use the short-term interest rate as their monetary-policy instrument. This is often the rate of interest on one of the facilities made available to the banks by the central bank, but (in principle) it can also be a market-determined interest rate that the central bank seeks to govern through operations in the (money) market. In the latter case, the relevant interest rate is often referred to as an "operational target". The Chart does not distinguish between instruments and operational targets. Some intermediate targets are "close to" instruments and therefore the intermediate target can relatively easily be observed by adjusting the instruments. Other instruments are "closer to" the ultimate target so that observing the intermediate target to a large extent contributes to meeting the ultimate target. Overall it can be said that exchange-rate targets are normally close to the instruments, while inflation targets are close to the ultimate target.

In academic literature, a distinction is often made between strict and flexible inflation targets, cf. e.g. Svensson (1997). In a regime with a strict inflation target, output and unemployment developments are not taken into account in policy-making, whereas these variables are taken into account when interest rates are determined in a regime with a flexible inflation target. In practice, however, all central banks with inflation targets operate with flexibility so that deviations from the inflation target are not necessarily sought to be eliminated as soon as possible. Instead, monetary policy is conducted so as to bring inflation close to the target over a certain horizon.

The European Central Bank, ECB, conducts its monetary policy with a view to observing the Treaty target of price stability within the euro area. The ECB has defined price stability as annual consumer price inflation below, but close to, 2 per cent in the medium term. Despite this explicit inflation target, the ECB is not included among the central banks operating with an inflation target regime. The ECB's policy-making process is not based on inflation forecasts. Instead, the ECB's monetary policy rests on two sets of analyses ("pillars"), known as economic and monetary analysis, respectively, cf. Chart 1.2.



Source: ECB. Background material for the ECB's press seminar on the evaluation of the ECB's monetary policy strategy, 8 May 2003.

Economic analysis is aimed at identifying risks to price stability in the short and medium term. It takes into account a wide range of economic and financial conditions in the assessment of the shocks to the economy of the euro area that will affect price developments. Monetary analysis is performed with a view to assessing medium- and long-term inflationary trends. The analysis comprises developments in numerous monetary indicators, including monetary growth and lending by banks. Monetary analysis primarily serves as a cross-check of the results of the economic analysis.

Denmark has opted for the exchange rate as the intermediate target for monetary policy, cf. Box 1.1, and since the early 1980s a consistent fixed-exchange-rate policy has been pursued, first against the D-mark and since 1999 against the euro. Over time, linking the Danish krone to the euro creates a basis for achieving the same level of inflation and inflation expectations in Denmark as in the euro area. If inflation is higher in Denmark than in the euro area, Denmark's competitiveness will, all other things being equal, deteriorate, leading to a loss of jobs in export sectors and in business sectors competing with imports. This dampens wage and price increases in Denmark, which eventually converge towards those of the euro area. Conversely, lower inflation in Denmark

THE FORMAL BASIS FOR DENMARK'S FIXED-EXCHANGE-RATE POLICY

Box 1.1

Under section 1 of the Danmarks Nationalbank Act¹, Danmarks Nationalbank is to "... maintain a safe and secure currency system in this country, and to facilitate and regulate the traffic in money and the extension of credit".

Under the Act, Danmarks Nationalbank has three main objectives:

- **Stable prices:** Danmarks Nationalbank helps to ensure stable prices, i.e. low inflation. This is done by using monetary policy to maintain a fixed exchange rate of the krone against the euro.
- **Secure payments:** Danmarks Nationalbank helps to ensure that cash and electronic payments can be settled in a secure manner. This is done by issuing banknotes and coins and by ensuring that banks can settle payments among themselves.
- **Stability of the financial system:** Danmarks Nationalbank helps to ensure the stability of the financial system. This is done by monitoring financial stability and payment systems, producing financial statistics and managing government debt.

Denmark has a long-standing tradition for basing its monetary policy on an exchange-rate target. In the latter half of the 1930s, the krone was pegged to the pound sterling. Later Denmark participated in the dollar-based fixed-exchange-rate system established under the auspices of the International Monetary Fund in the post-War years (the Bretton Woods system). This system broke down in the early 1970s. Subsequently the krone was linked to various European exchange-rate systems, initially the "Snake" and from 1979 the Exchange Rate Mechanisms (ERM I and II).

While Danmarks Nationalbank is responsible for monetary policy, exchange-rate policy is laid down by the Danish government in consultation with Danmarks Nationalbank. Section 2(3) of the Danish Act on Foreign Exchange² states, "Guidelines for the foreign-exchange policy to be conducted while the Act is in force shall be laid down after negotiation between Danmarks Nationalbank and the Royal Bank Commissioner".³ The agreement on Denmark's fixed-exchange-rate policy vis-à-vis the euro within a narrow fluctuation band of +/- 2.25 per cent around the central rate in ERM II was concluded at the informal meeting of the Ecofin Council on 25-27 September 1998 in Vienna between the ministers for economy and finance and the central bank governors of the EU member states.⁴

Danmarks Nationalbank is independent of the Danish government in its conduct of monetary policy. Under the Danmarks Nationalbank Act, it must notify the government prior to changing the discount rate, but irrespective of the position of the government it is up to the Board of Governors of Danmarks Nationalbank to make the decision. Although Denmark has not adopted the euro, Danmarks Nationalbank must comply with the independence requirement under the Maastricht Treaty. In March 1998, the European Monetary Institute, EMI, and the European Commission in their convergence reports concluded that the Danmarks Nationalbank Act is in compliance with central bank independence as defined in the Maastricht Treaty.

¹ Act no. 116 of 7 April 1936 on Danmarks Nationalbank.

² Consolidated Act on Foreign Exchange, etc. (Consolidated Act no. 279 of 11 April 1988).

³ The Royal Bank Commissioner is the formal link between the government and Danmarks Nationalbank. The Minister for Economic and Business Affairs is the Royal Bank Commissioner.

⁴ The communiqué of the meeting in Vienna can be found on p. 21 in Danmarks Nationalbank, *Monetary Review*, 4th Quarter 1998.

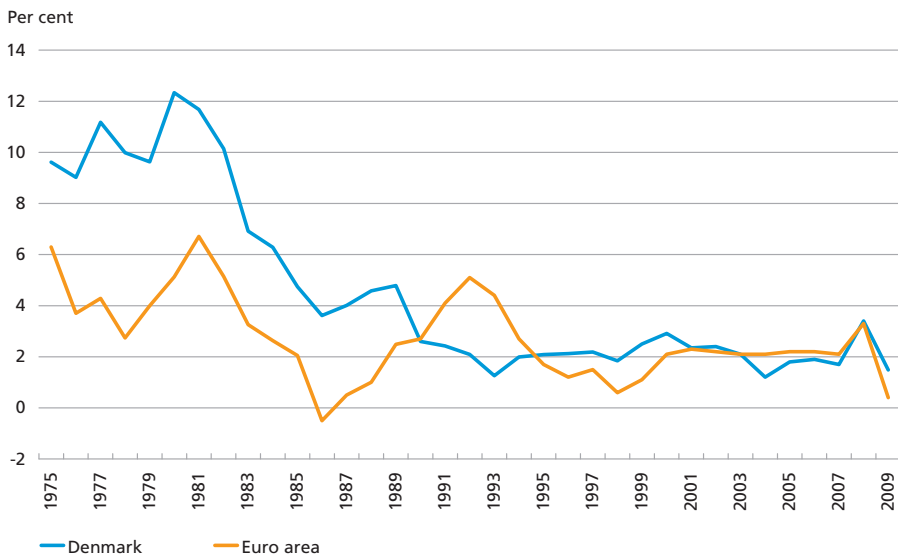
than in the euro area boosts employment in sectors competing with abroad, leading to upward pressure on inflation in Denmark, until it reaches the euro area level. Since the early 1990s, price developments in Denmark have indeed been in line with those of first Germany and later the euro area, cf. Chart 1.3.

Having the exchange rate as the intermediate target provides a simple, unambiguous rule for monetary policy in Denmark. Due to the fixed-exchange-rate policy, Danmarks Nationalbank's interest rates normally mirror those fixed by the ECB for the euro area. Danmarks Nationalbank irons out minor fluctuations in the exchange rate by purchasing and selling foreign exchange against kroner (intervention). If there is a prolonged tendency for the krone to strengthen or weaken, Danmarks Nationalbank unilaterally adjusts its interest rates. Weakening of the krone can be countered by raising Danmarks Nationalbank's interest rates relative to those of the ECB, since it is more attractive to invest in kroner when the rate of interest is higher. Conversely, Danmarks Nationalbank may counter a tendency for the krone to strengthen by reducing its interest rates.

A fixed-exchange-rate policy requires a stable currency area which can serve as an anchor for the exchange rate. In other words, if a small, open economy such as Denmark's is to base its monetary policy on a fixed exchange rate, it is necessary to have a large currency area such as the euro area that conducts its monetary policy with a view to maintaining price stability.

CONSUMER PRICE INFLATION 1975-2009

Chart 1.3



Note: Inflation in West Germany 1975-89 and Germany 1990-98. Preliminary annual averages for 2009.

Source: Statistics Denmark, ECB and OECD.

In the 1970s and 1980s, broad monetary aggregates were used as intermediate targets for monetary policy in several countries, but as financial innovations were introduced, the correlation between inflation and the money stock proved to be insufficiently stable for applying the money stock as a suitable intermediate target. Monetary aggregates have thus not played any key role in the formulation of e.g. US monetary policy since the early 1980s although it was to take almost 20 years longer before target zones for money growth were eliminated, cf. Bernanke (2006). Germany's money stock target was formally abolished at the end of 1998, but in practice there were considerable deviations between actual money growth and the targets set. The Bundesbank thus tended to consider inflationary developments rather than money growth when determining its interest-rate policies, cf. e.g. Neumann (2007).

Although central banks no longer seek to control money growth, many central banks and external observers continue to monitor and analyse developments in the money stock, not least credit developments, in order to use the information that such data may contain about current and future inflation and real-economic developments.

1.3 BACKGROUND TO DENMARK'S FIXED-EXCHANGE-RATE POLICY

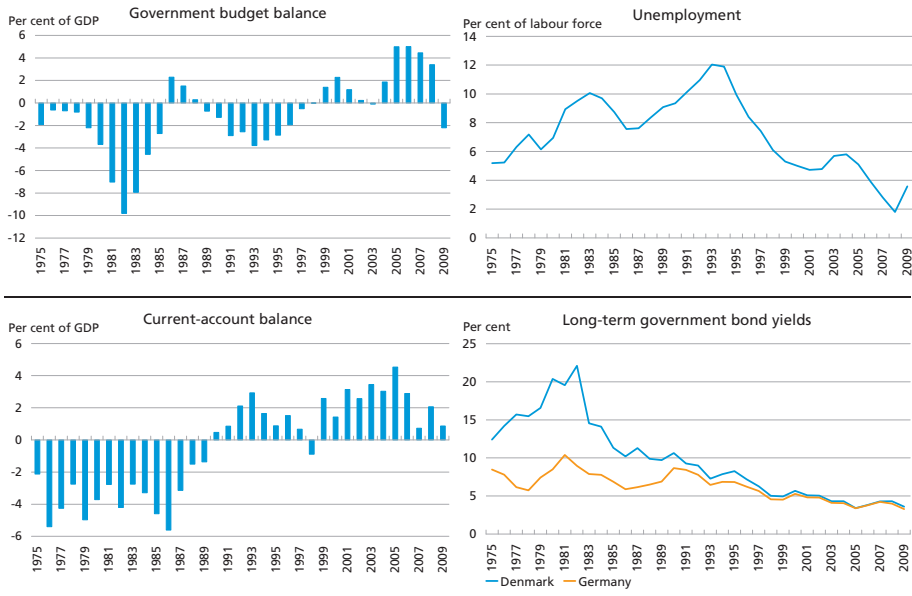
Developments in the Danish economy in the late 1970s and early 1980s were by no means satisfactory. Unemployment had risen to around 10 per cent of the labour force, inflation exceeded 10 per cent p.a., and wage increases could no longer keep up with prices, so real wages fell. The government budget deficit was escalating, approaching 10 per cent of the gross domestic product, GDP, and the yield on long-term government bonds exceeded 20 per cent. Expressions such as "the edge of the abyss" and "national bankruptcy" were the order of the day, and the seriousness of the situation was emphasised by the fact that, for the first time since the years around World War I, the Danish government had to pay higher rates of interest on its borrowing than those paid in the mortgage-credit sector, cf. Abildgren (2005). In addition, the current account of the balance of payments showed a chronic deficit. In short, there were massive imbalances in the Danish economy, cf. Chart 1.4.

In principle, Denmark conducted a fixed-exchange-rate policy within the framework of the European Monetary System, but in the period 1979-81 the krone was devalued by around 20 per cent vis-à-vis the D-mark.

In September 1982 the newly appointed government announced that it would refrain from adjusting the exchange rate as an economic policy measure. The stabilisation policy introduced by the new government

INDICATORS FOR THE DANISH ECONOMY 1975-2009

Chart 1.4



Note: Balance of payments stated as the net lending of the nation according to the national accounts. Government bond yield in West Germany. Forecasts for 2009, except the data on bond yields, which are preliminary annual averages.

Source: Danmarks Nationalbank and Statistics Denmark.

also led to tightening of fiscal policy and abolishment of cost-of-living adjustment ("dyrtidsregulering") of wages.

The promise to maintain a fixed exchange rate was put to the test very soon, as Sweden – Denmark's second most important trading partner – in October 1982 devalued its currency by 16 per cent. However, Denmark did not follow suit, and combined with other tightening measures this soon boosted the credibility of Denmark's economic policy. Faith in the fixed-exchange-rate policy gradually increased further in the following years as the government budget improved. Devaluation and inflation expectations were lowered, and the long-term yield spread to Germany narrowed from more than 13 per cent in 1982 to less than 1 per cent in 1991. By 1990, the rate of inflation was similar to that of Germany, and for the first time in more than 25 years the current account showed a surplus.

The challenge in relation to monetary and exchange-rate policies in the first half of the 1990s was to keep the fixed-exchange-rate policy on track despite several currency crises, widening of the fluctuation band within the Exchange Rate Mechanism, ERM, in 1993 from +/- 2.25 per cent to +/- 15 per cent, and sizeable devaluations by some of Denmark's major trading partners. This period also saw low growth in the Danish

economy, as well as several banking crises in Denmark. In spite of considerable exchange-rate fluctuations in 1993-95, the krone was steered successfully through the currency crises, and the exchange rate stabilised at close to its central rate against the D-mark. The introduction of the euro in 1999 and Denmark's participation in ERM II with a narrow fluctuation band for the krone of +/- 2.25 per cent have subsequently provided a steady anchor for the fixed-exchange-rate policy and low and stable inflation expectations in Denmark.

1.4 CREDIBILITY AND INDEPENDENCE

Monetary policy has a key impact on the inflation expectations of the households and the corporate sector, cf. e.g. Woodford (2003). Faith in the central bank's ability to ensure price stability via its monetary policy provides a steady anchor for the inflation expectations of the households and the corporate sector. Conversely, lack of trust in the ability and commitment of the central bank to maintain low and stable inflation puts this anchor in jeopardy. This was seen in many countries in the 1970s, when wage earners demanded wage increases to compensate for expected price inflation, and companies raised their prices in anticipation of higher payroll costs. This led to a "wage-price spiral" and high inflation.

Credibility is thus a cornerstone of effective monetary policy, irrespective of the strategy pursued by the central bank. Building up confidence among the public that the policies announced will actually be carried out normally takes years. The best approach is for the central bank consistently to demonstrate its ability and commitment to pursue the chosen strategy over a long period.

A central bank may seek to strengthen its credibility through transparency so that it can be made accountable for the monetary policy conducted. In a fixed-exchange-rate regime such as the Danish regime, monetary policy is inherently very transparent since the public will always be able to see whether the fixed exchange rate is maintained, i.e. whether the policy is on track. Moreover, Danmarks Nationalbank has a statutory obligation to publish an annual report on its activities in the preceding year. Finally, Danmarks Nationalbank presents its monetary and exchange-rate policies in its quarterly *Monetary Review* and in speeches and interviews, etc. in the course of the year.

The central bank's independence of the political system in its monetary-policy decisions provides the best foundation for achieving price stability, irrespective of the strategy pursued, cf. Cukierman (2008). An independent central bank will not be pressurised into implementing

monetary policy that conflicts with the objective of price stability. History has seen a number of unfortunate cases where the central bank was not independent and government war spending was financed via the banknote printing press (monetary financing), resulting in high inflation. Already in 1818, when Danmarks Nationalbank was established, great importance was attached to independence of the state, as the Danes' confidence in the purchasing power of their currency had to be restored following the hyperinflation of the Napoleonic War years and the "national bankruptcy" in 1813. Such examples are the background to the Maastricht Treaty's explicit ban on monetary financing of the public sector in the EU.

1.5 ECONOMIC POLICY: DISTRIBUTION OF RESPONSIBILITIES

The role of monetary policy in economic policy cannot be viewed in isolation. In a fixed-exchange-rate regime such as the Danish regime, monetary-policy interest rates are used exclusively for managing the exchange rate and therefore cannot be used to regulate the domestic business cycle. Thus, if Danmarks Nationalbank lowered its monetary-policy interest rates in order to stimulate the economy, the krone would weaken, and it would be necessary to raise interest rates again. Conversely, if Danmarks Nationalbank raised its interest rates in order to curb mounting inflationary pressures in the economy, the krone would strengthen and it would be necessary to cut interest rates.

Since monetary policy cannot be used for cyclical purposes, it is important that both fiscal policy and other economic policies are oriented towards economic stability so that both overheating and high unemployment are addressed. Stability-oriented fiscal policy is also of paramount importance to the fixed-exchange-rate policy. If fiscal policy were not oriented towards stability, but followed an inflation-generating track with budget deficits year after year, it would not be possible to maintain the exchange rate of the krone in the slightly longer term, as permanently higher inflation in Denmark than in other countries would lead to devaluation expectations.

Irrespective of the chosen exchange-rate regime, it is essential to price stability that the economy is flexible and adaptable. This particularly applies to the labour market, where flexible wage formation, job mobility and adaptable structures are key to ensuring that real wage formation is in line with productivity developments in the economy. If wage increases in a fixed-exchange-rate regime persistently exceed the level warranted by productivity enhancements, there is a risk of undermining price stability and competitiveness, to the detriment of growth and em-

ployment. Likewise, an economy governed according to an inflation target cannot in the long run sustain wage increases that exceed productivity developments without jeopardising price stability.

1.6 DOES THE OPTIMUM MONETARY-POLICY STRATEGY EXIST?

The choice of monetary-policy strategy is inherently fundamental, and experience generally shows that it takes time to build up the credibility of a regime. Moreover, it is difficult to say which monetary-policy strategy is generally most expedient when it comes to ensuring price stability and a favourable employment situation.

In many theoretical analyses, a fixed-exchange-rate regime cannot match a regime with floating exchange rates. The reason is that in these models the exchange rate is a price that can contribute to restoring equilibrium in the economy when it is hit by exogenous shocks. If this price is locked, one equilibrium-restoring force in the economy is eliminated, cf. Friedman (1953).

Empirical analysis provides a more diverse picture. Ball and Sheridan (2005) have analysed economic developments in 20 OECD countries, seven of which switched to inflation targets during the 1990s. Generally, they find no indications that the countries switching to inflation targets have fared better in terms of output, inflation and interest rates than the other countries. Christensen and Hansen (2007) have also analysed the impact of a switch of monetary-policy regime on the development in key macroeconomic variables for OECD countries in the period 1970-2005. Their conclusion is that switching to a consistent fixed-exchange-rate policy (including participation in a currency union) or to an inflation target both led to inflation below the global trend in the following years. Furthermore, it is found that transition to a fixed-exchange-rate policy has entailed a more favourable trade-off between fluctuations in inflation and in the output gap in the years following the change of regime, while transition to an inflation target has not brought improvements beyond the global trend.

Box 1.2 illustrates the situation in the Nordic countries. There do not seem to be any indications that the Danish economy has performed worse than the other Nordic economies since the mid-1990s in terms of output and inflation.

On the face of it, this empirical evidence may seem to be inconsistent with the above theoretical models. One possible explanation is that the fiscal-policy regime and labour-market structures depend on the monetary-policy regime, a factor that is normally disregarded in theoretical analyses. It is thus possible that the non-availability of monetary policy

as an instrument for stabilising the domestic business cycle compels both fiscal policies and the social partners to be more disciplined under a fixed-exchange-rate regime than in a situation with floating exchange rates. Moreover, it is possible that fluctuations in nominal exchange

INFLATION AND ECONOMIC ACTIVITY IN THE NORDIC REGION SINCE 1996

Box 1.2

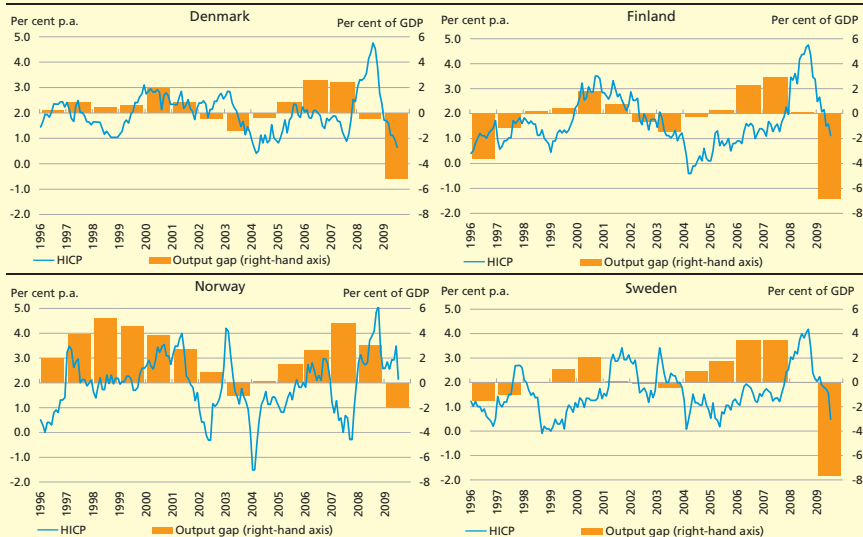
Since the mid-1990s, the Nordic countries have pursued different monetary-policy strategies, cf. Christensen and Hansen (2003):

- Denmark has conducted a fixed-exchange-rate policy against the D-mark and, from 1999, the euro.
- Finland switched to an inflation target in 1993. In 1996 it joined the ERM, and in 1999 it adopted the single European currency, the euro.
- Sweden has chosen to operate within the framework of an inflation target regime since 1995.
- Norway operated with a trade-weighted exchange-rate index until 2001, when it also switched to an inflation target.

Chart 1.5 shows inflation and output gaps for the four Nordic countries since 1996. Table 1.1 summarises a number of simple statistical measures of the level and volatility of inflation and output gaps. Among the four countries, Denmark has had the lowest volatility in inflation and output gap. Thus there does not seem to be any indications that Denmark's fixed-exchange-rate policy has led to more volatility in the economy compared with other small countries with other monetary-policy strategies – on the contrary. Moreover, in absolute terms the output gap in Denmark has on average been low, and average inflation has been around 2 per cent.

INFLATION (HICP) AND OUTPUT GAPS 1996-2009

Chart 1.5



Note: The output gap is a measure of actual GDP less potential GDP as a percentage of potential GDP. Output gaps for 2009 are forecasts.

Source: Reuters EcoWin and OECD.

CONTINUED	Box 1.2			
INFLATION AND OUTPUT GAPS 1996-2009				
	Denmark	Finland	Norway	Sweden
<i>Standard deviation</i>				
HICP, per cent year-on-year	0.77	1.03	1.15	0.92
Output gap, per cent of BNP	1.90	2.48	2.19	2.72
<i>Average</i>				
HICP, per cent year-on-year	2.01	1.67	1.93	1.60
Output gap, absolute level, per cent of BNP	0.83	1.17	3.88	1.03
Note: The output gap is a measure of actual GDP less potential GDP as a percentage of potential GDP. Output gaps for 2009 are forecasts. Source: Reuters EcoWin and OECD.				

rates act as shocks to the economy rather than stabilising factors since even in the slightly longer term volatility in real exchange rates often mirrors fluctuations in nominal exchange rates, cf. also Buiters (2000), Artis and Ehrmann (2006), and Söderström (2008).

Different countries may have different experiences as to the most efficient monetary-policy strategy. In Denmark's case a reliable fixed-exchange-rate policy – supported by stability-oriented fiscal policies – has proved to create a framework for stable economic development. Other countries have had success with other strategies.

1.7 LITERATURE

Abildgren, Kim (2005), Interest-rate development in Denmark 1875-2003 – a survey, *Danish Journal of Economics*, Vol. 143, No. 2.

Abildgren, Kim and Jens Thomsen (2008), The Role of Central Banks in Economic Policy (in Danish only), *Økonomi & Politik*, Vol. 81, No. 1.

Akerlof, George A., William T. Dickens, Robert J. Gordon, N. Gregory Mankiw and George L. Perry (1996), The macroeconomics of low inflation, *Brookings Papers on Economic Activity*, No. 1.

Angeloni, Ignazio, Anil K. Kashyap and Benoît Mojon (ed.) (2003), *Monetary policy transmission in the Euro Area*, Cambridge University Press.

Artis, Michael and Michael Ehrmann (2006), The exchange rate – A shock-absorber or source of shocks? A study of four open economies, *Journal of International Money and Finance*, Vol. 25.

Ball, Laurence and Niamh Sheridan (2005), Does inflation targeting matter? Published in Ben S. Bernanke and Michael Woodford (ed.), *The inflation-targeting debate*, The University of Chicago Press.

Bernanke, Ben S. (2003), An unwelcome fall in inflation? Speech at Economics Roundtable, University of California, San Diego, La Jolla, 23 July.

Bernanke, Ben S. (2006), Monetary aggregates and monetary policy at the Federal Reserve: A historical perspective. Speech at the Fourth ECB Central Banking Conference in Frankfurt, November.

Boskin, Michael J., Ellen R. Dulberger, Robert J. Gordon, Zvi Griliches and Dale W. Jorgenson (1998), Consumer prices, the consumer price index, and the cost of living, *Journal of Economic Perspectives*, Vol. 12, No. 1.

Buiter, Willem H. (2000), Optimal currency areas, *Scottish Journal of Political Economy*, Vol. 47, No. 3.

Christensen, Anders Møller and Niels Lynggård Hansen (2003), Volatility in Inflation and Economic Activity in the Nordic Countries, Danmarks Nationalbank, *Monetary Review*, 4th Quarter.

Christensen, Anders Møller and Niels Lynggård Hansen (2007), The monetary-policy regime and the development in central macroeconomic variables in the OECD countries 1970-2005, *Danmarks Nationalbank Working Papers*, No. 31, December.

Coenen, Günter (2003), Zero lower bound: Is there a problem in the euro area? Published in ECB, *Background studies for the ECB's Evaluation of its monetary policy strategy*.

Cukierman, Alex (2008), Central bank independence and monetary policymaking institutions – Past, present and future, *European Journal of Political Economy*, Vol. 24.

Friedman, Milton (1953), The case for flexible exchange rates. Published in Milton Friedman, *Essays in Positive Economics*, University of Chicago Press.

Gaspar, Victor, Alicia G. Herrero, Lex Hoogduin, Julian Morgan and Bernhard Winkler (ed.) (2001), *Why price stability?*, European Central Bank.

Neumann, Manfred J. M. (2007), Pre-commitment and guidance lessons from the Bundesbank's history. Published in ECB, *Monetary policy. A journey from theory to practice*.

Storgaard, Peter Ejler (2009), Wage Development in Denmark, Danmarks Nationalbank, *Monetary Review*, 2nd Quarter.

Svensson, Lars E. O. (1997), Inflation forecast targeting: implementing and monitoring inflation targets, *European Economic Review*, Vol. 41, No. 6.

Söderström, Ulf (2008), Re-evaluating Swedish membership in EMU: Evidence from an estimated model, *NBER Working Papers*, No. 14519.

Woodford, Michael (2003), *Interest and prices: Foundations of a theory of monetary policy*, Princeton University Press.

CHAPTER 2

Monetary-Policy Instruments

SUMMARY

As Denmark's central bank, Danmarks Nationalbank is responsible for monetary policy in Denmark. The fixed-exchange-rate policy means that the objective of monetary policy is to keep the Danish krone stable against the euro. Other considerations than the exchange rate – e.g. economic developments in Denmark – are not taken into account in relation to monetary policy. Danmarks Nationalbank conducts monetary policy by setting the monetary-policy interest rates, which are the discount rate, the current-account rate, the lending rate and the rate of interest on certificates of deposit. The lending and deposit facilities made available by Danmarks Nationalbank to the banks and mortgage-credit institutes accrue interest at these rates.

The monetary-policy interest rates are alternatives to the rate of interest on loans and deposits in the money market and are thus key to the money-market rates, which in turn have an impact on the development in the exchange rate of the krone vis-à-vis the euro. Danmarks Nationalbank can influence the krone rate by changing its monetary-policy interest rates. When they are raised the krone will, all other things being equal, tend to strengthen since it becomes more attractive to invest in kroner. The opposite effect is seen when monetary policy is eased.

In practice, Danmarks Nationalbank conducts its monetary policy via banks and mortgage-credit institutes in Denmark, also known as the monetary-policy counterparties. In this capacity, Danmarks Nationalbank holds accounts for the counterparties and manages the settlement of their mutual payments. Within certain limits, the counterparties can make demand deposits – current-account deposits – with Danmarks Nationalbank and participate in Danmarks Nationalbank's weekly open market operations, in which they can obtain 7-day loans by pledging securities as collateral or make 7-day deposits by purchasing certificates of deposit.

The monetary-policy instruments are used in the management of liquidity in the banking sector as a whole. The counterparties' current-

account deposits at Danmarks Nationalbank are the key liquidity concept in monetary policy as these funds can be used as means of payment without notice and at the initiative of the account holders.

2.1 THE MONETARY-POLICY INSTRUMENTS – A BRIEF OVERVIEW

Danmarks Nationalbank conducts monetary policy via its monetary-policy instruments, i.e. the facilities used by Danmarks Nationalbank to manage and remunerate accounts (lending and deposits) with banks and mortgage-credit institutes – the monetary-policy counterparties.

Danmarks Nationalbank's decisions concerning its monetary-policy interest rates are separate from its quantitative management of the monetary-policy counterparties' accounts with Danmarks Nationalbank. The monetary-policy interest rates are determined with the fixed-exchange-rate policy in mind. The management of the size of accounts is aimed at ensuring that the banking system as a whole always has sufficient liquidity.

The counterparties' accounts with Danmarks Nationalbank

The monetary-policy counterparties have access to two facilities at Danmarks Nationalbank:

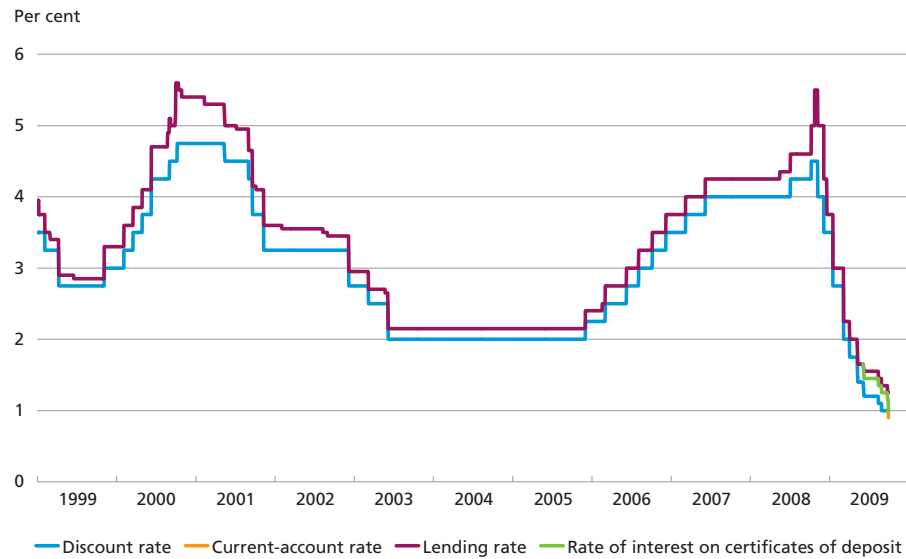
- Open market operations, in which the counterparties, on the last banking day of each week, have the option to borrow funds for 7 days against securities as collateral or deposit funds for 7 days by purchasing certificates of deposit.
- Current accounts, in which the counterparties can place liquidity on demand. The balance of a current account cannot be negative at the close of the day.

In the weekly open market operations, the monetary-policy counterparties normally manage their accounts with Danmarks Nationalbank so as to ensure that their total deposits in current accounts meet the banking sector's expected liquidity requirement in the subsequent week.

If necessary, Danmarks Nationalbank conducts extraordinary open market operations to offset liquidity fluctuations.

Setting the monetary-policy interest rates

Danmarks Nationalbank conducts monetary policy by setting the monetary-policy interest rates, which are the discount rate, the current-account rate, the lending rate and the rate of interest on certificates of deposit. These interest rates are determined by the Board of Governors of Danmarks Nationalbank and may be changed at any time as required.

DANMARKS NATIONALBANK'S MONETARY-POLICY INTEREST RATES Chart 2.1

Note: The lending rate and the rate of interest on certificates of deposit were identical until 8 June 2009, when a small margin was introduced between the two. The discount rate was identical to the current-account rate until 29 September 2009.

Source: Danmarks Nationalbank.

The rate of interest on Danmarks Nationalbank's monetary-policy loans is higher than the rate of interest on certificates of deposit.¹ Current-account deposits accrue interest at the current-account rate, which, in turn, is lower than the rate of interest on certificates of deposit, cf. Chart 2.1. The discount rate is a signal rate indicating the general level of monetary-policy interest rates in Denmark. None of the monetary-policy instruments directly accrue interest at the discount rate.²

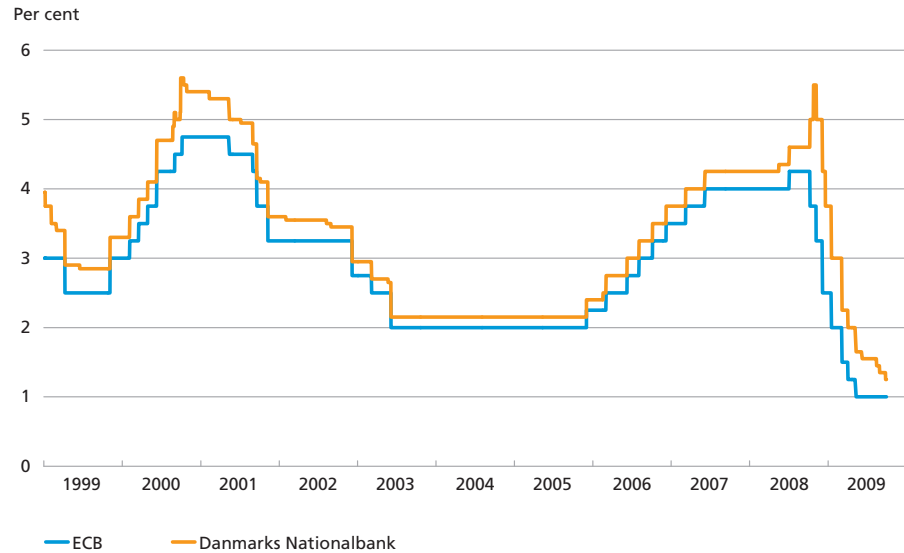
The monetary-policy interest rates are key to interest rates in the money market, where banks and mortgage-credit institutes lend to each other, cf. Chapter 4. On average, the banks' interest rates usually follow the monetary-policy interest rates relatively closely, cf. Chapter 5. At times, Danmarks Nationalbank's lending rate (and rate of interest on certificates of deposit) has been adjusted more frequently and in smaller increments than the discount rate. This reflects how Danmarks Nationalbank sometimes, e.g. in periods of short-term currency unrest, chooses to raise its lending rate without changing the discount rate. This mainly affects money-market interest rates, which influence capital flows and the exchange rate of the krone, while the banks' retail interest rates are to a certain extent shielded. The banks normally only

¹ The lending rate and the rate of interest on certificates of deposit were identical until 8 June 2009, when a small margin was introduced between the two.

² The discount rate was identical to the current-account rate until 29 September 2009.

THE ECB'S AND DANMARKS NATIONALBANK'S LENDING RATES IN THEIR OPEN MARKET OPERATIONS

Chart 2.2



Note: For the ECB: fixed allotment rate in the main refinancing operations from 1999 to end-June 2000; minimum bid rate from end-June 2000 to mid-October 2008; after that fixed allotment rate.

Source: Danmarks Nationalbank.

change their retail interest rates when they expect changes in monetary-policy interest rates to be more permanent since changing the interest rates offered to customers involves certain costs.¹

Overall considerations in relation to monetary-policy instruments

The design of the monetary-policy instruments reflect Denmark's fixed-exchange-rate policy vis-à-vis the euro. This policy entails that Danmarks Nationalbank's lending rate normally follows that of the European Central Bank, ECB, cf. Chart 2.2. In the event of a sustained strengthening or weakening of the krone against the euro, Danmarks Nationalbank unilaterally adjusts its interest rates, cf. Chapter 3.

Moreover, the structure of the monetary-policy instruments should aim to ensure that the banking sector has sufficient liquidity.² This contributes to financial stability and secure settlement of payments. In addition, the instruments should support a well-functioning money market in which liquidity in the banking system is distributed efficiently on market terms and money-market interest rates reflect monetary-policy interest rates.

¹ Carlsen and Fæste (2007) analyse the pass-through from Danmarks Nationalbank's interest rates to the banks' retail interest rates.

² Liquidity is defined as the banks' and mortgage-credit institutes' current-account deposits, cf. section 2.2.

Within the framework of the monetary-policy regulations applying at any time, Danmarks Nationalbank always reserves the right to change the rules of the game without notice if this is deemed to be necessary in the interests of monetary and foreign-exchange policy.

2.2 DANMARKS NATIONALBANK IS BANKER TO THE BANKS

Danmarks Nationalbank is often referred to as banker to the banks. Historically, this is because Danmarks Nationalbank holds the sole right to issue banknotes in Denmark. Danmarks Nationalbank was approached when new banknotes were needed, and one of its key tasks was to ensure a sufficient supply of banknotes so that, for example, the circulation was large when economic activity was high.

Banknote issuance no longer plays any role in monetary policy. It is easier, cheaper and safer to handle large transactions electronically rather than using physical banknotes and coins, and the banks have no interest in holding large supplies of banknotes and coins, which do not accrue interest. Nowadays banknotes are primarily used by the households for everyday purchases, but to some extent they are also used for savings purposes.

Today, the role of banker to the banks is chiefly reflected in the fact that the monetary-policy counterparties have access to interest-bearing demand accounts (current accounts) at Danmarks Nationalbank. The counterparties' current-account deposits are the key liquidity concept in monetary policy as these funds can be used as means of payment without notice and at the initiative of the account holders. Current-account deposits are therefore often referred to as liquidity, current-account liquidity or krone liquidity. Via the current accounts, the counterparties settle transactions among themselves and with Danmarks Nationalbank using the latter's payment system, Kronos.¹ Danmarks Nationalbank acts as settlement bank to the counterparties in Kronos.

Danmarks Nationalbank can manage liquidity in the banking sector as a whole and influence money-market interest rates because the monetary-policy counterparties demand current-account liquidity and because Danmarks Nationalbank, as the sole supplier of current-account liquidity, can determine the terms and conditions for access. Overall the monetary-policy counterparties do not have access to more liquidity than Danmarks Nationalbank provides. The counterparties can trade liquidity among themselves, but they cannot create liquidity.

¹ Payment systems and settlement procedures are described in more detail in Danmarks Nationalbank (2005).

The reason why the monetary-policy counterparties demand current-account liquidity is that such claims on Danmarks Nationalbank are accepted as risk-free and can always be used for settlement of accounts among the counterparties and between the counterparties and Danmarks Nationalbank. This is because Danmarks Nationalbank's solvency is beyond doubt and because Danmarks Nationalbank is able to expand the volume of liquidity, should the need arise, so that the banking system as a whole always has sufficient liquidity to settle its payments.¹

If the only option available to the banking sector was to settle payments via mutual claims, the credit and settlement risks would be higher.² When the banks and mortgage-credit institutes use current-account liquidity for settlement of their payments and Danmarks Nationalbank acts as settlement bank, the risk of a systemic crisis in the banking sector is reduced. This is due to the lower risk that uncertainty concerning one credit institution's financial strength leads to a domino effect whereby more and more participants are unable to meet their obligations.

It is thus one of Danmarks Nationalbank's primary tasks to ensure that the banking sector as a whole always has sufficient liquidity to settle its payments. This task can be broken down into two closely linked functions:

- Monetary-policy function: ensuring sufficient liquidity in the banking system as a whole at the close of the day when the counterparties' balances with Danmarks Nationalbank are settled.
- Payment-system function: ensuring that sufficient liquidity is available to the banking system during the day.

As regards the monetary-policy function, Danmarks Nationalbank manages liquidity via its open market operations, in which it provides or absorbs liquidity at given times. As regards the payment-systems function, Danmarks Nationalbank provides intraday liquidity by permitting current accounts to be overdrawn against pledging of collateral. Box 2.1 illustrates the relationship between monetary policy and payment systems.

2.3 CURRENT-ACCOUNT DEPOSITS

Current-account deposits with Danmarks Nationalbank are demand deposits which the monetary-policy counterparties may use as means of

¹ See Tucker (2004) and Woodford (2001) for further discussions of this topic.

² Goodhart (1985) discusses the central bank's liquidity function and role in the settlement of interbank accounts in more detail.

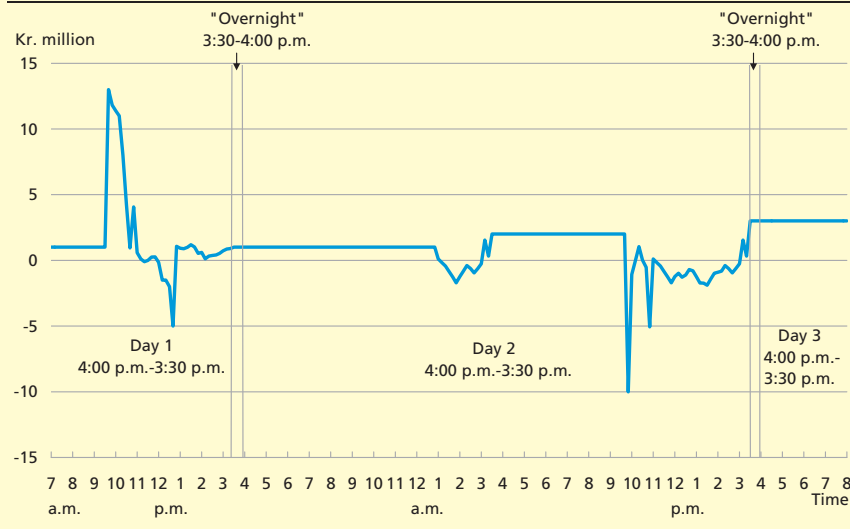
MONETARY POLICY AND PAYMENT SYSTEMS

Box 2.1

The following provides a simplified example of the relationship between monetary policy and settlement of payments in Denmark. The example considers a single participant in the payment system. It is assumed that the participant is a monetary-policy counterparty holding only one account with Danmarks Nationalbank for settlement of both payments and monetary-policy instruments. During a monetary-policy day, the account may be overdrawn against collateral, but overdrafts from one day to another are not permitted. The monetary-policy day runs from 4:00 p.m. to 3:30 p.m. on the following banking day. In other words, negative balances (overdrafts) are not permitted "overnight" in the period from 3:30 p.m. to 4:00 p.m. on the same calendar day. Chart 2.3 shows how the balance of the participant's account at Danmarks Nationalbank might develop over three monetary-policy days.

EXAMPLE OF DEVELOPMENT IN PARTICIPANT'S CURRENT-ACCOUNT BALANCE

Chart 2.3



During the monetary-policy day, liquidity is withdrawn from and deposited in the account as various payments are settled. Danmarks Nationalbank's payment system, Kronos, is open for payments in Danish kroner between 7:00 a.m. and 4:30 p.m., except between 3:30 and 4:00 p.m. when the counterparties' accounts with Danmarks Nationalbank are settled in connection with the start of a new monetary-policy day. Outside the opening hours, balances may only fluctuate as a result of settlement of payments related to securities registered with VP Securities or in connection with the Sumclearing retail payment system.

The individual participant's liquidity may fluctuate considerably over the day. If payment system participants did not have access to overdraft facilities at Danmarks Nationalbank within a monetary-policy day, but instead had to settle such fluctuations among themselves, this would require considerable money-market transactions during the day, both in numbers and in volumes. Generally, the overdraft facility provides for more flexible settlement of payments since it prevents situations where individual system participants have insufficient liquidity in their accounts at Danmarks Nationalbank to settle payments as required. This reduces the risk of queues and delayed settlement of payments.

payment without notice and at their own initiative. These accounts play a key role in monetary policy and payment systems in Denmark:

- Danmarks Nationalbank's lending to and deposits from its monetary-policy counterparties are settled via their current accounts.
- Danmarks Nationalbank's other transactions with its counterparties, including foreign-exchange transactions, are also settled via the current accounts.
- The current accounts are the backbone of Danmarks Nationalbank's payment system, Kronos, in which considerable liquidity transfers between counterparties take place on a daily basis.
- Large payments to and from the central government are also handled via the current accounts.

The current-account deposits of the monetary-policy counterparties accrue interest at the current-account rate, which is an overnight interest rate, i.e. a rate of interest on 1-day deposits. The current-account rate is lower than the rate of interest on certificates of deposit, typically 0.1-0.5 per cent lower, but there are no fixed rules. This helps to ensure that the monetary-policy counterparties have an incentive to plan their liquidity requirements and actively settle liquidity fluctuations among themselves on market terms in the money market rather than passively placing their liquidity in current accounts.

Current-account limits

A ceiling (limit) has been set for the monetary-policy counterparties' total current-account deposits at the close of the day (i.e. at the close of the monetary-policy day at 3:30 p.m.). The overall limit is approximately kr. 25 billion, broken down as individual current-account limits for the counterparties. The purpose of these limits is to prevent the build-up of large current-account deposits at Danmarks Nationalbank that may be used without notice for speculation in interest-rate and exchange-rate changes if the krone is under pressure.

If the customers of the monetary-policy counterparties wish to speculate against the krone for a larger amount than the current-account deposit, the excess amount must be financed via provision of liquidity by Danmarks Nationalbank. The terms and conditions for such liquidity are not known at the time of the speculative transaction. Danmarks Nationalbank has the option to charge a rate of interest on such liquidity which is so high that any speculation gain is eliminated.

The current-account limits of the individual counterparties only apply if the counterparties' total current-account deposits exceed the overall limit. In other words, the monetary-policy counterparties may exceed

their individual limits, provided that the overall limit is not exceeded. Deposits exceeding the individual limits accrue interest at the current-account rate as long as the overall current-account limit is not exceeded. If the overall limit is exceeded at the close of the day, deposits exceeding the individual limits will be converted into certificates of deposit. When the money and foreign-exchange markets are calm, Danmarks Nationalbank, via its open market operations in certificates of deposit, ensures that the current-account limits do not impede the daily settlement of payments. Consequently, it has been necessary to convert current-account deposits into certificates of deposit only once since the system of current-account limits was introduced in June 1999, cf. Box 2.2. In special circumstances it has, however, been necessary temporarily to suspend the current-account limits, as was the case in September 2008 in connection with turmoil in the money market and large demand for liquidity.

The individual current-account limits have been determined on the basis of the counterparties' activities in the money market. Counterparties with extensive activity in the money market, which are key contributors to smooth exchange of liquidity, have the highest current-account limits. The limits are updated on a regular basis.

Overall, the current-account limits contribute to ensuring a well-functioning money market since the counterparties are encouraged to exchange liquidity among themselves.

2.4 OPEN MARKET OPERATIONS

Danmarks Nationalbank uses two instruments in its open market operations: monetary-policy loans against securities as collateral, and certificates of deposit issued by Danmarks Nationalbank.

Monetary-policy loans and certificates of deposit both have a maturity of 7 days. The rate of interest payable on loans is higher than the rate of interest on certificates of deposit.¹ Certificates of deposit are zero-coupon papers for which the remuneration is the difference between the purchase price and the redemption price.

Danmarks Nationalbank conducts regular open market operations once a week, cf. Box 2.3. In principle, these operations should adjust the current-account deposits at Danmarks Nationalbank so that they are sufficient to cover the counterparties' liquidity requirements in the coming week. In the intermediate periods, it is up to the market participants to smooth liquidity fluctuations by exchanging liquidity among themselves

¹ The lending rate and the rate of interest on certificates of interest were identical until 8 June 2009.

CONVERSION OF CURRENT-ACCOUNT DEPOSITS INTO CERTIFICATES OF DEPOSIT

Box 2.2

On 2 March 2006, the ECB decided to raise the minimum bid rate by 0.25 percentage points to 2.50 per cent, and Danmarks Nationalbank followed suit.

It had been expected that the ECB would raise its interest rate, and in the preceding months this had been reflected in money-market interest rates in both the euro area and Denmark. Prior to the increase, a number of banks and mortgage-credit institutes deposited large sums in their current accounts at Danmarks Nationalbank. Since the total current-account limit of approximately kr. 25 billion was thereby exceeded, kr. 9.1 billion of the total current-account deposit was converted into certificates of deposit.

This was the first time since the introduction of the present system of current-account limits in June 1999 that developments in the current-account deposits of banks and mortgage-credit institutes led to such conversion. The process was smooth and did not give rise to any problems in day-to-day settlement of payments.

in the money market. The margin between the lending rate and the rate of interest on certificates of deposits gives the banks and mortgage-credit institutes an incentive to turn to the money market rather than using Danmarks Nationalbank's facilities. This supports a well-func-

REGULAR WEEKLY OPEN MARKET OPERATIONS

Box 2.3

Danmarks Nationalbank's regular open market operations are conducted on the last banking day of each week. Danmarks Nationalbank's sales of certificates of deposits take place between 10:00 a.m. and 3:30 p.m., while loan transactions can be concluded between 10:00 a.m. and 1:00 p.m. The opening hours are shorter for loans than for certificates of deposit so that in periods of turmoil in the foreign-exchange markets Danmarks Nationalbank can gain an overview of the counterparties' overall liquidity situation well before the close of the monetary-policy day.

In the regular open market operations, monetary-policy loans and certificates of deposit normally have maturities of 7 days.

Both monetary-policy loans and certificates of deposit are settled on the day of the operation with immediate liquidity effect. There are no quantitative restrictions on the counterparties' purchases of certificates of deposit or raising of monetary-policy loans.

When a loan transaction is concluded, the loan is debited to a loan account and the proceeds are credited to the current account. When the loan matures, the interest is debited to the loan account, after which the amount of the loan, with interest, is transferred from the current account to the loan account. The loan falls due for payment before Danmarks Nationalbank's payment system, Kronos, opens on the expiry date.

When a certificate of deposit is purchased, the purchase price (market value) is debited to the current account, while the nominal value of the certificate is registered on the certificate-of-deposit account. When the certificate of deposit matures, its nominal value (par) is credited to the current account of the relevant counterparty before Kronos opens and debited to the certificate-of-deposit account.

tioning money market in which the liquidity requirements of counterparties with a liquidity shortage are met by counterparties with a liquidity surplus, at market interest rates reflecting the official interest rates.

Danmarks Nationalbank uses an "open window" in its weekly open market operations. Danmarks Nationalbank sets the 7-day interest rates on loans and certificates of deposit, after which the counterparties are free to determine the volume of monetary-policy loans and deposits. Likewise the counterparties themselves structure their holdings of certificates of deposit and their current-account deposits – within the framework of the current-account limits. The current-account deposits and certificates of deposit reflect a trade-off between liquidity and remuneration. Current-account deposits entail a loss of interest as the rate of interest on certificates of deposit is higher than the current-account rate. On the other hand, only current-account deposits are fully liquid and can be used for payments without notice and at the initiative of the counterparties themselves. Counterparties can, however, gain access to liquidity by selling certificates of deposit in Danmarks Nationalbank's extraordinary open market operations or in the money market.

Since the current accounts may not be overdrawn at the close of the day, Danmarks Nationalbank provides liquidity on an extraordinary basis if all counterparties taken as one are short of liquidity, e.g. on days when large payments to the central government fall due. In its open market operations, Danmarks Nationalbank will always ensure a sufficient supply of current-account funds to prevent overdrafts at the end of the day. Likewise, Danmarks Nationalbank will conduct open market operations to ensure that the overall limit for current-account deposits is observed. Extraordinary open market operations usually take place in certificates of deposit, which can be sold or purchased with an immediate liquidity effect. Typically, certificates of deposit are purchased and sold in connection with known fluctuations in central-government payments or large, unexpected liquidity fluctuations related to Danmarks Nationalbank's purchase and sale of foreign exchange, cf. Box 2.4.

Certificates of deposit may be traded among the monetary-policy counterparties, but may not be traded outside this group. The reason is that certificates of deposit are in fact merely 7-day deposits in accounts (certificate-of-deposit accounts) at Danmarks Nationalbank, and only the monetary-policy counterparties have access to such accounts. Trade in certificates of deposit between counterparties does not change their total liquidity, but can be used to exchange liquidity without credit risk for settlement on the same day. So far, trade in certificates of deposit among counterparties has, however, been relatively modest compared with other transactions in the money market, cf. Chapter 4.

EXTRAORDINARY OPEN MARKET OPERATIONS

Box 2.4

Danmarks Nationalbank's extraordinary open market operations comprise sale and buy-back of certificates of deposit. Danmarks Nationalbank sells certificates of deposit in order to absorb liquidity and buys them back in order to provide liquidity.

In buy-backs of certificates of deposit a distinction is usually drawn between two types of operations:

- Buy-backs of certificates of deposit in connection with known, large central-government receipts that have been announced beforehand in Danmarks Nationalbank's forecasts of central-government payments.
- Buy-back of certificates of deposit in connection with fluctuations in the factors affecting liquidity compared to the forecasts, primarily owing to shifts in central-government payments and sale of foreign exchange by Danmarks Nationalbank. Usually, such operations are not announced until the day of the operation.

In connection with the buy-back of certificates of deposit, Danmarks Nationalbank adds a premium to the rate of interest on certificates of deposit when calculating the price of the certificate. The premium may be fixed or variable, e.g. related to a market interest rate. Since August 1997, all certificates of deposit have been bought back with a premium of 0.05 percentage points. The premium serves as an incentive for counterparties to deposit sufficient liquidity in their current accounts in the regular open market operations so that payment fluctuations within the next week can be handled without overdrawing the account. No premiums (or discounts) apply to the interest rate on sale of certificates of deposit in extraordinary open market operations.

On average 2-3 pre-announced extraordinary operations are conducted every month and one unannounced extraordinary operation every other month.

2.5 DANMARKS NATIONALBANK'S BALANCE SHEET AND THE ACCOUNTS OF THE MONETARY-POLICY COUNTERPARTIES

Danmarks Nationalbank's balance sheet reflects its tasks, including conduct of monetary and foreign-exchange policies and issuance of banknotes and coins. Moreover, Danmarks Nationalbank is banker to the Danish government. Danmarks Nationalbank holds considerable assets in foreign exchange and in Danish kroner by way of the foreign-exchange reserve and the portfolio of domestic bonds. On the liabilities side, the large items are banknotes and coins in circulation, the deposits of the central government and the banks and mortgage-credit institutes at Danmarks Nationalbank, and Danmarks Nationalbank's net capital. The main items on Danmarks Nationalbank's balance sheet are shown in Table 2.1 and described in more detail in Box 2.5.

The net position is the monetary-policy counterparties' total net accounts in kroner with Danmarks Nationalbank for monetary-policy purposes. It is defined as the counterparties' holdings of certificates of

MAIN ITEMS OF DANMARKS NATIONALBANK'S BALANCE SHEET, END- 2008		Table 2.1	
Assets	Kr. billion	Liabilities	Kr. billion
Portfolio of domestic bonds	27.3	Central government's account .	262.8
Foreign-exchange reserve	211.7	Banknotes and coins	61.3
Monetary-policy lending	240.9	Certificates of deposit	118.5
Other assets, net	30.5	Current accounts	9.7
		Net capital	58.1

Note: Net foreign-exchange reserve. The "other assets, net" item comprises other assets less other liabilities.
Source: Danmarks Nationalbank.

deposit and current-account deposits less monetary-policy loans, cf. Table 2.2. The monetary-policy counterparties' accounts with Danmarks Nationalbank are stated on Danmarks Nationalbank's balance sheet.

Autonomous factors on Danmarks Nationalbank's balance sheet

All other items on Danmarks Nationalbank's balance sheet – except for the items relating to the net position – are normally referred to as autonomous factors. These mainly comprise banknotes and coins in circulation, the central government's account at Danmarks Nationalbank and the foreign-exchange reserve. The value of banknotes and coins in circulation depends on the demand for cash among the general public, the balance of the central government's account depends on incoming and outgoing payments, and fluctuations in the foreign-exchange reserve primarily reflect Danmarks Nationalbank's intervention in the market to keep the krone stable. For example, when the central government makes disbursements or Danmarks Nationalbank purchases foreign exchange, the monetary-policy counterparties acquire liquidity.

By definition, the autonomous factors on Danmarks Nationalbank's balance sheet match the net position of the monetary-policy counterparties vis-à-vis Danmarks Nationalbank. Changes in the autonomous factors are therefore reflected in equivalent changes in the net position. Thus, if Danmarks Nationalbank supports the exchange rate of the krone by purchasing kroner from a bank against foreign exchange, the

MONETARY-POLICY INSTRUMENTS AND NET POSITION, END-2007 AND END-2008				Table 2.2
Kr. billion	2007	2008	Change	
Current-account deposits	9.4	9.7	0.2	
+ Holdings of certificates of deposit	200.5	118.5	-81.9	
- Monetary-policy loans	216.8	240.9	24.1	
= Net position of the counterparties	-6.9	-112.7	-105.8	

Source: Danmarks Nationalbank.

MAIN ITEMS ON DANMARKS NATIONALBANK'S BALANCE SHEET

Box 2.5

The assets side of Danmarks Nationalbank's balance sheet is dominated by the foreign-exchange reserve, monetary-policy lending and the portfolio of domestic bonds. The foreign-exchange reserve gives Danmarks Nationalbank contingency funds to intervene in the foreign-exchange market in order to stabilise the krone vis-à-vis the euro, cf. Chapter 3. The portfolio of domestic bonds comprises Danish bonds. Previously, e.g. in the 1960s, Danmarks Nationalbank's purchases and sales of krone-denominated bonds in the market were seen as an important monetary-policy instrument for influencing the bond yield and economic activity. Today domestic bonds are simply investment assets for Danmarks Nationalbank.

The liabilities side is dominated by Danmarks Nationalbank's responsibilities as issuer of banknotes and coins and as banker to the banks and mortgage-credit institutes and to the central government.

The value of banknotes and coins in circulation depends on demand from the general public and the corporate sector. The development in banknotes and coins in circulation is primarily determined by private consumption and savings patterns.¹

Seigniorage is the profit Danmarks Nationalbank makes from issuing banknotes and coins. When banks receive cash, they acquire debt to Danmarks Nationalbank (or their current-account deposit is reduced). The debt (or deposit) accrues interest at the monetary-policy rates. Banknotes and coins, on the other hand, can be seen as interest-free loans to Danmarks Nationalbank. The difference between zero and the monetary-policy interest rates is thus the profit accruing to Danmarks Nationalbank.²

Danmarks Nationalbank is also banker to the Danish government, whose account is used for settlement of large-value receipts and disbursements. The EU Treaty stipulates that the balance of the account must not be negative at the close of the day. This provision is aimed at preventing EU member states from financing central-government deficits by borrowing from central banks, i.e. monetary financing. In Denmark, the "funding rule" provides a further framework for government borrowing. In short, this rule implies that the central government's domestic borrowing in kroner for the full year should normally match its gross domestic financing requirement, i.e. its current deficit and servicing of its domestic debt. Other public authorities (local government) do not hold accounts at Danmarks Nationalbank. Their receipts and disbursements are handled via the banks.

The central government's retail disbursements have been outsourced to the banking sector, which means that Danmarks Nationalbank disburses a lump sum to a bank that handles the further process. Typically incoming payments to the central government, e.g. VAT, are also received via banks, which then forward them to Danmarks Nationalbank.

Trust in Danmarks Nationalbank is founded on its indisputable solvency. Its net capital should therefore be substantial in relation to its balance sheet and activities so that earnings considerations do not impede its conduct of monetary and foreign-exchange policies. Danmarks Nationalbank cannot avoid incurring certain financial risks arising from its role as a public authority, cf. Danmarks Nationalbank (2004). Danmarks Nationalbank's management of financial risk is characterised by prudence. A low level of risk makes it possible to maintain a high degree of solvency, even in periods when market conditions are extreme. Danmarks Nationalbank's profit after provisions is transferred to the central government.

¹ See Carlsen and Riishøj (2006) for an analysis of banknotes and coins in circulation.

² The compilation of seigniorage at Danmarks Nationalbank is described in Pedersen and Wagener (2000).

IMPACT OF VARIOUS FACTORS ON THE NET POSITION	Table 2.3
Kr. billion	2008
Danmarks Nationalbank's intervention purchases of foreign exchange, net	-20.0
Danmarks Nationalbank's non-intervention purchases of foreign-exchange, net	0.2
Danmarks Nationalbank's purchases of foreign exchange, net	-19.8
Danmarks Nationalbank's purchases of bonds, net	0.7
Central government's liquidity impact	-111.5
Other factors	24.8
Change in net position	-105.8

Note: Intervention purchases of foreign exchange are Danmarks Nationalbank's purchases and sales of foreign exchange for kroner in the market with a view to stabilising the krone. Danmarks Nationalbank's other purchases of foreign exchange include e.g. interest on the foreign-exchange reserve and the central government's net payments in foreign exchange. The central government's liquidity impact is its gross domestic financing requirement less its gross domestic borrowing.

Source: Danmarks Nationalbank.

foreign-exchange reserve is reduced, and so is the net position because the current-account deposit becomes lower. Another example is a government payroll disbursement, which reduces the balance of the central government's account and increases the current-account deposit correspondingly so that the net position increases.

Some transactions by Danmarks Nationalbank do not affect the net position, e.g. foreign-exchange transactions with the central government. When the government raises a foreign loan, Danmarks Nationalbank exchanges the proceeds in foreign exchange for kroner. In this case, only the central government's account at Danmarks Nationalbank and the foreign-exchange reserve grow.

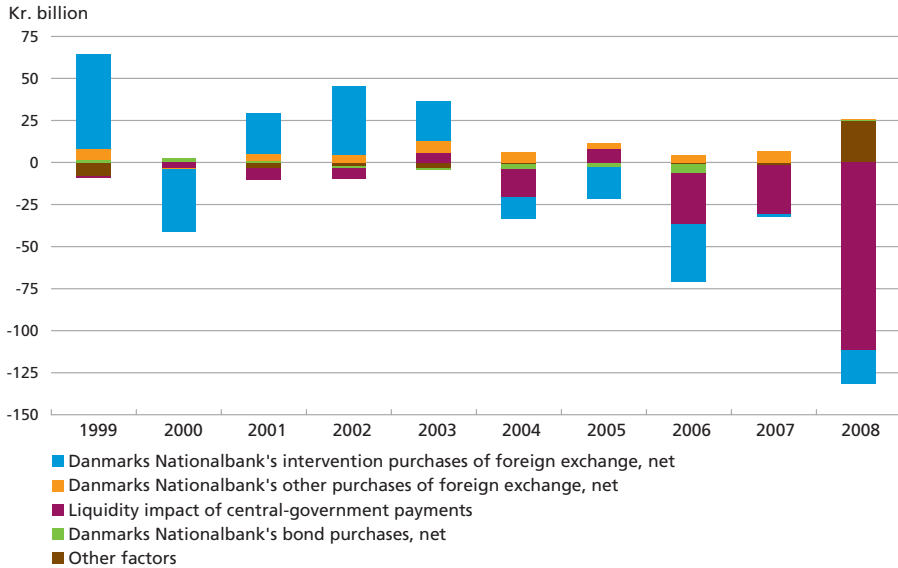
The impact of autonomous factors on the net position is often described by the factors impacting on liquidity¹, broken down into the liquidity impacts of the central government and Danmarks Nationalbank, respectively, cf. Table 2.3.

Particularly Danmarks Nationalbank's purchase and sale of foreign exchange and the central government's net payments affect the net position on an annual basis. Fluctuations in the net position as a result of other autonomous factors are usually small, cf. Chart 2.4.

¹ By definition, the total change in the autonomous factors is identical to the change in the factors impacting on liquidity.

IMPACT OF VARIOUS FACTORS ON THE NET POSITION

Chart 2.4



Note: The large negative liquidity impact of central-government payments in 2008 reflects the central government's financing of Bank Rescue Package II to Danish banks and mortgage-credit institutes in 2009. See Danmarks Nationalbank (2009b) for a description of Bank Rescue Package II.

Source: Danmarks Nationalbank.

2.6 USE OF MONETARY-POLICY INSTRUMENTS BY COUNTERPARTIES¹

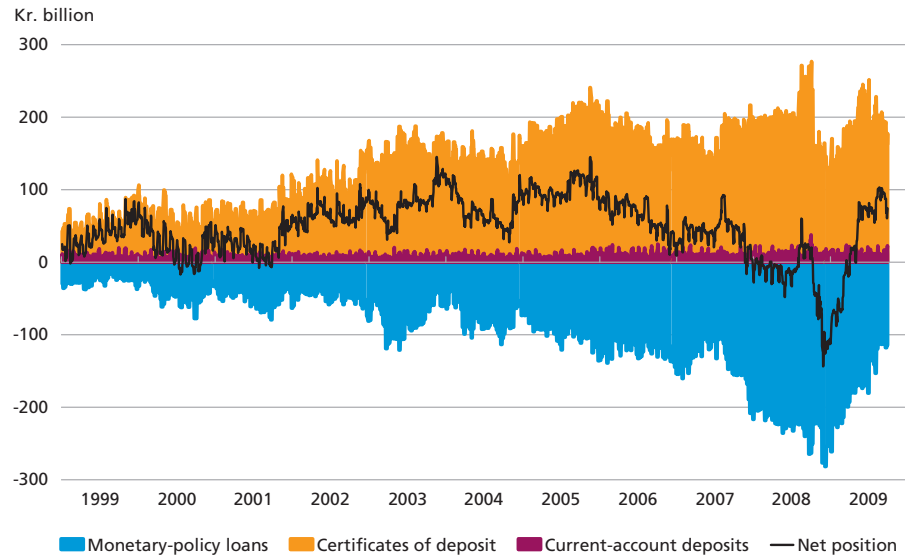
The counterparties' demand for monetary-policy loans and certificates of deposit depends on their net position, but even if this is negative they may wish to hold a certain volume of certificates of deposit. The reason is that the counterparties taken as one can only procure extra liquidity during the week by selling back certificates of deposit to Danmarks Nationalbank in extraordinary open market operations. The certificates of deposit enable the individual counterparty to procure liquidity, either by selling back to Danmarks Nationalbank or by trading or pledging the certificates of deposit in the money market. Certificates of deposit are thus part of the counterparties' liquidity contingency.

In recent years, the volume of monetary-policy loans has risen more than warranted by the development in the net position, cf. Chart 2.5. Consequently, the increase to a large extent reflects a rise in the counterparties' holdings of certificates of deposit. The more widespread use of certificates of deposit is attributable to factors such as a rising volume of payments linked to refinancing of mortgage-credit loans, particularly

¹ See Danmarks Nationalbank (2003) for a further description of the use of monetary-policy instruments.

NET POSITION OF THE MONETARY-POLICY COUNTERPARTIES VIS-À-VIS
DANMARKS NATIONALBANK

Chart 2.5



Source: Danmarks Nationalbank.

at the turn of the year when refinancing activity is traditionally considerable. Demand for certificates of deposit also rose in the autumn of 2007 in connection with the financial turmoil that had erupted that summer, cf. Kjærgaard and Risbjerg (2008). The margin between the lending rate and the rate of interest on certificates of deposit introduced on 8 June 2009 is aimed at giving banks and mortgage-credit institutes a greater incentive to exchange liquidity in the money market rather than using Danmarks Nationalbank's facilities. The effect of this margin is difficult to quantify, but after its introduction the banks and mortgage-credit institutes taken as one have reduced their gross use of Danmarks Nationalbank's facilities.

Box 2.6 shows one month's day-to-day fluctuations in the net position as a result of movements in the various factors affecting liquidity. The Box also illustrates how changes in the net position lead to fluctuations in the counterparties' use of the monetary-policy instruments.

A large part of the day-to-day fluctuations in the net position relate to central-government payments. To facilitate the monetary-policy counterparties' liquidity planning, Danmarks Nationalbank therefore regularly publishes forecasts of central-government payments on a day-by-day basis. At the same time, Danmarks Nationalbank announces the dates for its planned purchase and sale of certificates of deposit.¹

¹ Danmarks Nationalbank's liquidity management is described in more detail in Danmarks Nationalbank (2009a).

USE OF THE MONETARY-POLICY INSTRUMENTS IN PRACTICE

Box 2.6

Table 2.4 shows day-to-day changes in the net position in September 2007 and the resulting fluctuations in the use of instruments.

DAY-TO-DAY CHANGES IN NET POSITION, SEPTEMBER 2007

Table 2.4

Date	Impact on net position from					Change in counter-parties' net position	Change in net position broken down by		
	Central-government liquidity impact (a)	Danmarks Nationalbank's purchase of foreign exchange	Danmarks Nationalbank's purchase of bonds	Bank-notes and coins	Other		Current-account deposit	Certificates of deposit	Monetary-policy loans ("-" indicates increased borrowing)
3 (Mon)	-9.5	-1.3	0.0	-0.1	0.1	-10.7	-0.7	-10.0	0.0
4 (Tue)	15.5	0.5	0.0	0.0	0.0	16.0	4.1	11.9	0.0
5 (Wed)	-5.8	-0.7	0.0	0.1	0.7	-5.7	-3.8	-2.0	0.0
6 (Thu)	-0.3	0.2	0.0	0.1	-0.2	-0.2	-0.2	0.0	0.0
7 (Fri)	0.4	0.0	0.0	0.0	0.1	0.4	3.9	-9.0	5.6
10 (Mon)	0.3	0.3	0.0	0.1	-0.4	0.5	0.5	0.0	0.0
11 (Tue)	-1.3	-0.3	0.4	0.1	0.3	-0.9	-0.9	0.0	0.0
12 (Wed)	0.1	0.1	0.0	0.3	-0.1	0.4	0.4	0.0	0.0
13 (Thu)	0.9	0.0	0.0	0.1	0.0	0.9	0.9	0.0	0.0
14 (Fri)	0.7	0.0	0.0	0.0	0.0	0.8	0.4	-3.9	4.3
17 (Mon)	0.5	0.2	0.0	0.1	-0.1	0.6	0.6	0.0	0.0
18 (Tue)	-0.3	-0.2	0.0	0.2	0.1	-0.2	-0.2	0.0	0.0
19 (Wed)	-4.4	0.1	0.0	0.1	-0.2	-4.4	-4.4	0.0	0.0
20 (Thu)	-0.9	-0.2	0.2	0.0	0.0	-0.8	-0.8	0.0	0.0
21 (Fri)	-0.1	-0.1	0.1	0.0	0.1	0.1	4.2	11.4	-15.5
24 (Mon)	-2.7	0.0	0.1	0.0	0.0	-2.7	-2.7	0.0	0.0
25 (Tue)	1.4	1.3	0.0	0.0	-1.4	1.2	1.2	0.0	0.0
26 (Wed)	-16.4	-1.2	0.0	-0.2	1.3	-16.4	4.1	-20.5	0.0
27 (Thu)	-0.3	-7.0	0.0	-0.3	0.0	-7.7	-4.9	-2.8	0.0
28 (Fri)	12.2	0.1	0.0	-0.4	0.2	12.1	1.1	13.1	-2.0

(a) Gross domestic financing requirement less the central government's gross domestic borrowing.

Fluctuations in the net position during the month were mainly attributable to the central government's payments and Danmarks Nationalbank's net foreign-exchange purchases, while fluctuations in the other items were small. Changes in the net position, the central government's payments and Danmarks Nationalbank's net foreign-exchange purchases (accumulated over the month for all three) are shown in Chart 2.6.

On the instruments side of the Table it is seen that there were four regular weekly open market operations (Fridays) and five extraordinary open market operations in which holdings of certificates of deposit changed. On the remaining 11 banking days liquidity adjustment was smooth and there was no need for operations on the part of Danmarks Nationalbank. On these days the current accounts absorbed the fluctuations in the net position. Three of the extraordinary operations had been announced beforehand, two had not. The number of extraordinary open market operations in September 2007 was higher than the monthly average of around three.

CONTINUED

Box 2.6

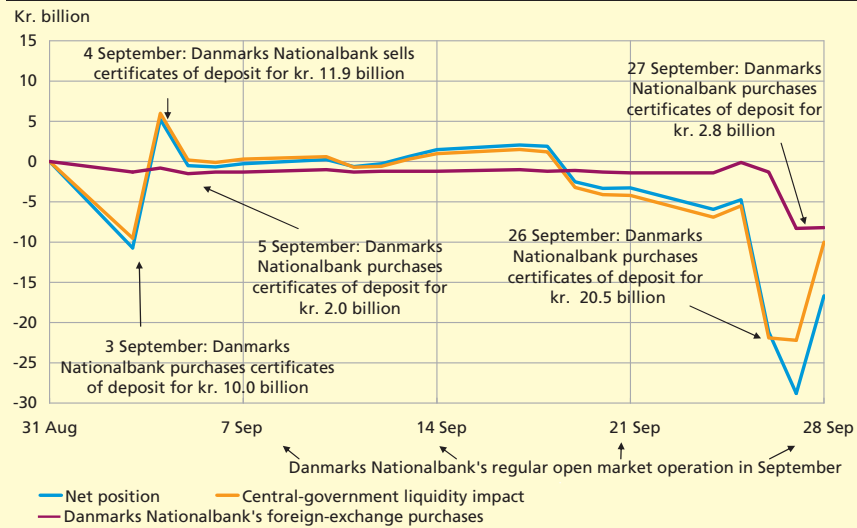
On Monday, 3 September and Wednesday, 26 September, buy-back of certificates of deposit by Danmarks Nationalbank had been pre-announced, while sale of certificates of deposit had been pre-announced on Tuesday, 4 September.

On the first banking day of the month (3 September in this example) considerable liquidity is usually withdrawn from the banking sector (the monetary-policy counterparties taken as one) in connection with tax payments to the central government. On this day Danmarks Nationalbank was therefore open for buy-back of certificates of deposit. On the second banking day (4 September in this example) Danmarks Nationalbank is usually open for sale of certificates of deposit to counterparties in connection with central government disbursements (subsidies to local government, etc.). Another drain on the banking sector is often seen later in the month when VAT payments are made. In this example, Danmarks Nationalbank had therefore pre-announced buy-back of certificates of deposit on 26 September. Towards the end of the month the banking sector typically receives liquidity again when the central government disburses salaries, pensions, student grants, etc. In September 2007, Danmarks Nationalbank conducted a regular open market operation on this day (28 September).

Unannounced operations in certificates of deposit were required on two occasions. On 5 September, the liquidity-draining effect of central-government finances was greater than anticipated. The counterparties' current-account deposits thus became low, and Danmarks Nationalbank decided to provide a small amount of liquidity by buying back certificates of deposit. On 27 September an unannounced buy-back operation took place, since Danmarks Nationalbank sold foreign exchange for kr. 8.4 billion towards the end of September, thereby reducing the counterparties' current-account deposits.

CHANGES IN NET POSITION, CENTRAL-GOVERNMENT LIQUIDITY IMPACT, DANMARKS NATIONALBANK'S FOREIGN-EXCHANGE PURCHASES (ACCUMULATED), AND DANMARKS NATIONALBANK'S OPEN MARKET OPERATIONS IN SEPTEMBER 2007

Chart 2.6



Source: Danmarks Nationalbank.

2.7 DANMARKS NATIONALBANK'S MONETARY-POLICY COUNTERPARTIES

Danmarks Nationalbank's monetary-policy counterparties are banks and mortgage-credit institutes operating pursuant to the Danish Financial Business Act who meet certain technical requirements, including being connected to Danmarks Nationalbank's payment system, Kronos. Danmarks Nationalbank also gives Danish branches of foreign credit institutions with corresponding activities access to the monetary-policy instruments.

Monetary-policy considerations govern Danmarks Nationalbank's choice of monetary-policy counterparties. Banks and mortgage-credit institutes have substantial lending and deposit activities and thus play a key role in the transmission of Danmarks Nationalbank's interest-rate adjustments to the economy in general. The selection criteria are based on an assumption that the large monetary-policy counterparties are active in the money market and thus contribute to ensuring a well-functioning marketplace with effective price formation.

At end-2008 there were 118 monetary-policy counterparties in Denmark, of which 113 were banks and 5 mortgage-credit institutes. The total number of banks and mortgage-credit institutes in Denmark was around 150. The banks and mortgage-credit institutes that do not have direct transactions with Danmarks Nationalbank (typically small banks) manage their liquidity via accounts with other banks, i.e. correspondent banks.

Monetary-policy loans are usually distributed on a relatively small number of counterparties. The number varies with the net position, but normally some 20 counterparties have loans at Danmarks Nationalbank. The number of counterparties holding certificates of deposit is generally somewhat higher, typically in the range of 50-60. Although the number of counterparties in the open market operations is limited, it is fully sufficient to ensure the transmission of Danmarks Nationalbank's interest-rate adjustments and to provide liquidity for the entire banking sector.

The five counterparties with the largest monetary-policy loans typically account for around 80 per cent of total borrowing, while the five counterparties with the largest holdings of certificates of deposit hold approximately 80 per cent of the outstanding volume.

2.8 COLLATERAL BASIS FOR CREDIT FACILITIES AT DANMARKS NATIONALBANK

As a general rule, Danmarks Nationalbank requires collateral for all credit facilities, cf. Box 2.7.¹ This applies not only to monetary-policy

¹ The principles for pledging of collateral to Danmarks Nationalbank are described in more detail in Pedersen (2009).

COLLATERAL BASIS

Box 2.7

As a main rule, Danmarks Nationalbank gives account holders access to loans in Danish kroner against the following securities in Danish kroner and euro as collateral:

- Securities issued by the Kingdom of Denmark.
- Bonds guaranteed by the Kingdom of Denmark.
- Bonds issued by KommuneKredit and Danish Ship Finance.
- Mortgage-credit bonds and covered bonds issued by institutions subject to the Financial Business Act.
- Bonds issued by Føroya Landstýri (the Faroese government).

The securities must be registered with VP Securities and traded at OMX Nasdaq, Copenhagen. Under the arrangement, a pool of securities pledged to Danmarks Nationalbank in a VP securities account can be used as collateral for both monetary-policy and intraday loans. In practice, a counterparty transfers the securities to be used as collateral to a VP securities account pledged to Danmarks Nationalbank. During the term of the loan, the counterparty may exchange the securities by first depositing other securities in the pledged account and then withdrawing securities.

Day-to-day fluctuations in the price of the securities pledged mean that the value of the pledged account constantly changes. To minimise the risk that the value of the counterparty's monetary-policy loans exceeds the value of the securities pledged, the collateral value of the securities is calculated as their market price less a deduction (haircut) that depends on the specific securities and their remaining maturity, coupon type and liquidity (negotiability), cf. Table 2.5.

When determining the haircut, eligible securities are divided into four categories:

- Category 1: Securities issued by the Kingdom of Denmark.
- Category 2: Mortgage-credit bonds, covered bonds and Danish Ship Finance bonds with a circulating volume of more than 1 billion euro or the equivalent value in Danish kroner. The bonds must also be comprised by the Danish Securities Dealers Association's price-quoting system and have at least three price quoters.
- Category 3: Other mortgage-credit bonds, covered bonds and Danish Ship Finance bonds, as well as bonds guaranteed by the Kingdom of Denmark.
- Category 4: KommuneKredit bonds and bonds issued by Føroya Landstýri.

HAIRCUTS FOR SECURITIES WITH FIXED COUPON RATE, PER CENT

Table 2.5

Remaining life	Category 1	Category 2	Category 3	Category 4
0-1 year	0.5	1.0	1.5	6.5
1-3 years	1.5	2.5	3.0	8.0
3-5 years	2.5	3.5	4.5	9.5
5-7 years	3.0	4.5	5.5	10.5
7-10 years	4.0	5.5	6.5	11.5
> 10 years	5.5	7.5	9.0	14.0

Source: Danmarks Nationalbank.

The collateral value of the securities and the haircuts are calculated in accordance with guidelines laid down by the ECB, cf. ECB (2008b).

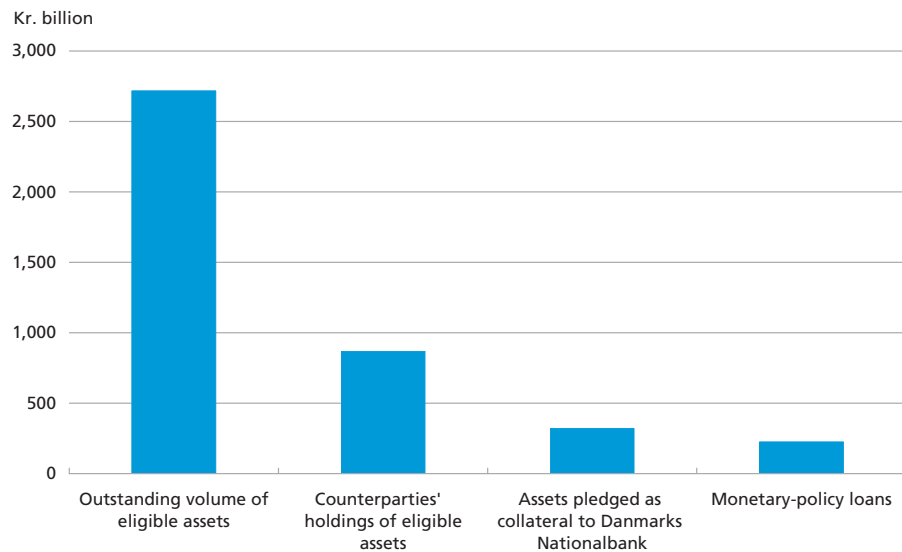
loans, but also to e.g. intraday loans. The collateral pledged protects Danmarks Nationalbank against losses, which is of paramount importance to its credibility.

In 2008, assets with total value of kr. 2,700 billion were eligible as collateral to Danmarks Nationalbank. Almost one third of these assets were held by monetary-policy counterparties, cf. Chart 2.7.

The increased use of monetary-policy instruments in recent years is reflected in the volume of securities pledged to Danmarks Nationalbank as collateral. The increase is primarily in the form of securities that are not particularly tradable (liquid), cf. Chart 2.8. The securities pledged as collateral to Danmarks Nationalbank are often difficult to pledge in the private market.

ELIGIBLE ASSETS AND MONETARY-POLICY LOANS IN 2008

Chart 2.7

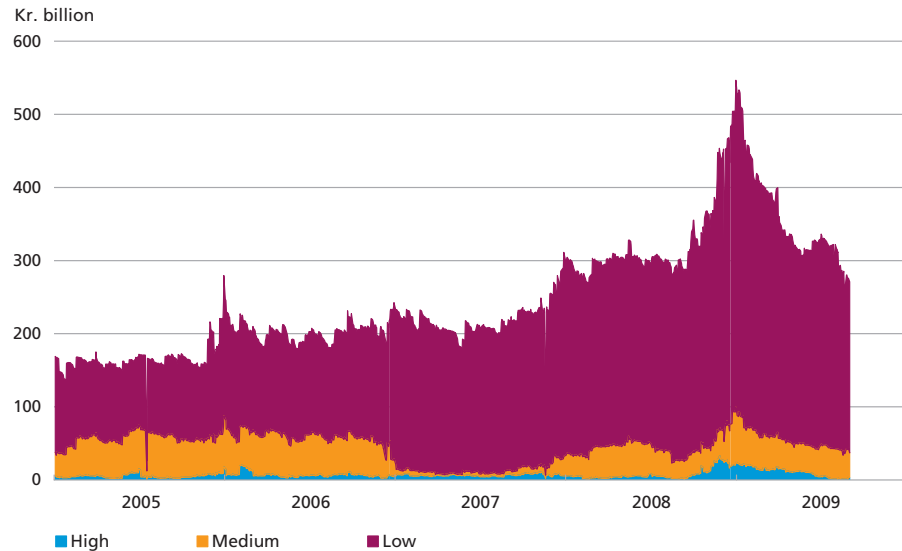


Note: The outstanding volume and the counterparties' holdings of eligible assets are averages of monthly holdings. Assets pledged as collateral and monetary-policy loans are averages of daily values. Assets pledged as collateral cover assets that can be used for both monetary-policy loans and intraday loans. In addition to the assets pledged as collateral to Danmarks Nationalbank, counterparties may pledge their holdings of certificates of deposit as collateral for intraday loans from Danmarks Nationalbank.

Source: Danmarks Nationalbank.

**SECURITIES PLEDGED AS COLLATERAL TO DANMARKS NATIONALBANK
BROKEN DOWN BY DEGREE OF TRADABILITY**

Chart 2.8



Note: Pledged securities that can be used as collateral for both monetary-policy loans and intraday loans. High tradability corresponds to category 1, medium to category 2 and low to categories 3 and 4 in Box 2.7. These categories are used to determine haircuts and are not necessarily an exact representation of the relative tradability of the individual securities. The minimum volume in circulation for securities to be included in category 2 was increased from 2007.

Source: Danmarks Nationalbank.

2.9 COMPARISON WITH THE MONETARY-POLICY INSTRUMENTS IN OTHER COUNTRIES

In practice, monetary policy can be implemented in many ways. The central banks' different approaches to the use of monetary-policy instruments reflect a number of factors, including various considerations to be taken into account and the relative weighting of these considerations. Typically, central banks implement their monetary policies through market-oriented instruments designed to manage short-term money-market interest rates.¹

Monetary-policy instruments generally include open market operations whereby the central bank provides liquidity at specific times, as well as standing facilities that can be used by the counterparties at their own initiative. This is also the case for the ECB. The ECB operates with reserve requirements, meaning that over a given period of time each bank must have a certain average deposit with its national central bank.

¹ In connection with the financial turmoil that commenced in the summer of 2007, and the subsequent financial crisis, some central banks have also sought to influence longer-term interest rates, see section 2.10. The financial crisis in Denmark is elaborated on in Danmarks Nationalbank (2008a, 2008b and 2009b).

OVERVIEW OF MONETARY-POLICY INSTRUMENTS							Table 2.6
	ECB	Federal Reserve	Bank of England	Sveriges Riksbank	Norges Bank	Danmarks Nationalbank	
Key policy interest rate ¹ (maturity) ...	1 week	1 day	1 week	1 week	1 day	1 week	
Reserve requirement	Yes	Yes	Yes	No	No	No	
Standing lending facility	Yes	Yes	Yes	Yes	Yes	No	
Standing deposit facility ²	Yes	No	Yes	Yes	Yes	Yes	
Certificates of deposit ³	No	No	No	Yes	Yes	Yes	
Regular open market operations ⁴	Yes	Yes	Yes	Yes	No	Yes	
Frequency ⁵	Week	Day	Week	Week	-	Week	
Maturity ⁶	1 week	1-14	1 week	1 week	-	1 week	
			days				

Note: As a main rule, the instruments included are those that the central banks used before the onset of the financial turmoil in the summer of 2007, after which supplementary facilities have been introduced, cf. section 2.10.

Source: Market Committee (2009), Kran (2001), Borio and Nelson (2008) and central bank websites.

¹ ECB: lending rate in the weekly refinancing operations. Federal Reserve: the Federal Funds Target Rate, i.e. the target for the overnight interest rate. Bank of England: the Bank Rate, i.e. the rate of interest in the weekly open market operations. Sveriges Riksbank: the repo rate in the weekly open market operations. Norges Bank: the rate of interest on overnight deposits with Norges Bank. Danmarks Nationalbank: the lending rate.

² In October 2008, the Federal Reserve began to pay interest on reserve requirements and other deposits that had not previously accrued interest.

³ In the context of the financial crisis, the Bank of England introduced Sterling Bills in October 2008 in order to absorb liquidity.

⁴ Main open market operations. Norges Bank conducts open market operations as required.

⁵ The Federal Reserve does not have a fixed calendar of open market operations, but they typically take place on a daily basis. Sveriges Riksbank also conducts open market operations on a daily basis.

⁶ The maturity of the Federal Reserve's open market operations is typically 1-14 days. For Norges Bank, the maturity depends on the liquidity situation.

Table 2.6 provides an overview of the monetary-policy instruments of selected central banks.

Standing facilities

A very simple set of monetary-policy instruments would be one only comprising a "standing facility" giving counterparties access, at their own initiative, to unlimited collateralised overnight borrowing and to deposits at the same rate of interest.¹

The primary argument against restricting the central banks' range of instruments to a standing facility with the same rate of interest on loans and deposits is that all day-to-day lending and deposit activity by the banks would then take place via the central bank. In other words, there would not be any market-based day-to-day money market.²

¹ Standing facilities were previously the dominant monetary-policy instrument, cf. Bindseil (2004). This was also the case in a number of small western European countries until the mid-1980s, after which market operations came into more widespread use, cf. Forssbæck and Oxelheim (2007).

² Other arguments against this very simple set-up put forward by Tucker (2004) include large fluctuations on the central-bank balance sheet, as well as hoarding of liquidity and inefficient liquidity management by banks because there is no premium on liquidity contingency by way of standing-facility deposits.

An interest-rate corridor, whereby the lending rate is higher than the deposit rate in the standing facility, provides an incentive for efficient liquidity management and also supports trade in liquidity in the money market. A wide spread between the lending and deposit rates under a standing facility will lead to shifts in the level of the money-market interest rates when the sign of the net position changes. In that case, the overnight interest rate would be close to the rate of interest on the banks' deposits with the central bank when the net position was positive, while it would be close to the rate of interest on collateralised loans from the central bank when the net position was negative. In a Danish context, such major shifts that affect the money-market interest rates would influence the development in the exchange rate of the krone. Given the fixed-exchange-rate policy this is not expedient. If the spread becomes too narrow, banks with a liquidity surplus or deficit do not really have an incentive to use the money market rather than the central bank's facilities, with a risk that the short-term money market dries up.¹

The ECB offers a standing facility whereby the banks can, on a daily basis and at their own initiative, borrow at a higher rate of interest than in its open market operations and deposit liquidity at a lower rate of interest. This is a way of preventing extensive volatility in market interest rates, which will remain within the corridor between lending and deposit rates under the standing facility.

Danmarks Nationalbank does not offer a standing lending facility. In a Danish context it is essential that money-market interest rates can respond if the krone comes under pressure. Short-term money-market interest rates should be able to rise freely in periods of tight liquidity, e.g. when the exchange rate of the krone is subject to turmoil and foreign exchange is flowing out of the country. Rising interest rates will inherently dampen the outflow of foreign exchange, thereby supporting the fixed-exchange-rate policy.²

Open market operations

Typically central banks mainly provide liquidity via open market operations, i.e. regular or extraordinary liquidity operations conducted at the initiative of the central bank. In the intermediate periods, it is up to the market participants to smooth liquidity fluctuations by exchanging liquidity among themselves. The maturity and frequency of central-bank open market operations depend on supply and demand effects on central-bank liquidity from the autonomous factors, among other things.

¹ However, there will still be a basis for a market providing liquidity to participants that do not themselves have access to the central bank's standing facilities, cf. Bindseil and Würtz (2007) and Mayes and Toporwski (2007).

² The relationship between the monetary-policy instruments and monetary and foreign-exchange policy targets is discussed in Tucker (2004).

The Governing Council of the ECB meets once a month to set the level of interest rates in the weekly main refinancing operations, through which the ECB provides liquidity as 7-day collateralised loans. The ECB also provides loans with longer maturities, e.g. three months. Moreover, the ECB can conduct fine-tuning operations in the event of unexpected liquidity fluctuations, etc. that affect interest rates in the short-term money market.

It must be possible to adjust monetary-policy interest rates in Denmark at any time if warranted by the krone rate. The fixed-exchange-rate policy entails that Denmark's Nationalbank's interest rates normally follow the ECB's lending rate in its main refinancing operations. If there is a prolonged tendency for the krone to strengthen or weaken, Denmark's Nationalbank unilaterally adjusts its interest rates.

Danmark's Nationalbank operates with 7-day maturities for its monetary-policy loans and conducts regular open market operations on a weekly basis. This is in line with the terms applying to monetary-policy loans in the ECB's main refinancing operations. Denmark's Nationalbank has an "open window" in its weekly open market operations, meaning that the counterparties are free to determine the volume of monetary-policy loans and deposits at the rates of interest fixed by Denmark's Nationalbank. This is a simple and transparent way of providing liquidity and managing interest rates when no other factors have to be taken into account, such as managing the volume of liquidity provided to the counterparties.

In the period from 1999 until October 2008, the ECB managed the volume of liquidity provided in its market operations. From 1999 until end-June 2000 these were fixed-rate tenders, while liquidity was allotted at variable marginal rates in the period until October 2008. In the context of the financial crisis the ECB began to carry out its weekly main refinancing operations as fixed-rate tenders with full allotment from October 2008.

Reserve requirements

The ECB operates with reserve requirements whereby the all banks must maintain certain average minimum deposits with their national central bank within each reserve maintenance period of about one month. The reserves accrue interest at the average rate of interest in the ECB's main refinancing operations during the reserve maintenance period, while any deposit in excess of the reserve requirement does not accrue interest.¹ The banks have an incentive to lend liquidity in the money market

¹ The banks also have the option to place funds under the ECB's standing deposit facility, which does accrue interest, but at a lower rate than the required reserves. The Federal Reserve did not previously pay interest on required reserves, but in October 2008 it began to do so, one of the aims being to improve its ability to manage the overnight interest rate.

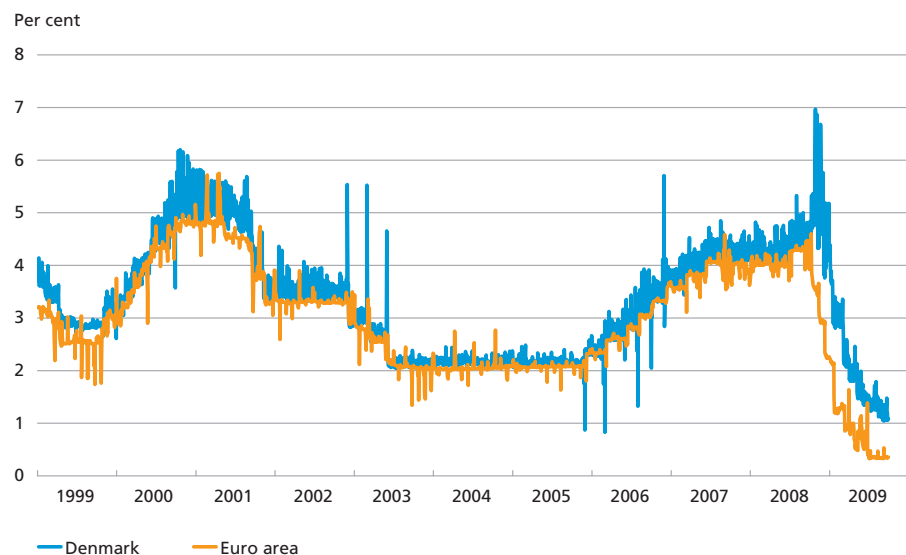
when the overnight interest rate is high compared to the interest paid on deposits in reserve requirement accounts. On the other hand, the banks have an incentive to maintain ample reserves in periods when the overnight interest is low. The reserve requirement thus helps to smooth fluctuations in the overnight money-market interest rate.

In Denmark it is not a requirement that the monetary-policy counterparties hold minimum deposits with Danmarks Nationalbank. On the contrary, current-account deposits are subject to certain limits that have been introduced with a view to reducing liquidity that may be used without notice for speculation against the krone. There are no restrictions on the counterparties' holdings of certificates of deposit, which can only be converted into liquidity in Danmarks Nationalbank's open market operations.

Chart 2.9 shows overnight interest rates in the euro area and Denmark. The ECB normally seeks to stabilise very short-term money-market interest rates at a level close to the rate of interest in its weekly main refinancing operations. In practice, it has focused on Eonia, the overnight interest rate in the uncollateralised money market. Fluctuations in overnight interest rates in Denmark may appear to be relatively large compared with those of the euro area. However, direct compari-

OVERNIGHT INTEREST RATES IN DENMARK AND THE EURO AREA

Chart 2.9



Note: The Tomorrow-Next rate for Denmark and Eonia for the euro area. 14-day maturities for monetary-policy loans and certificates of deposit led to considerable technical fluctuations in the overnight interest rate in Denmark due to interest-rate speculation in relation to changes in monetary-policy interest rates in 2002-03 and 2005-06. Consequently, Danmarks Nationalbank introduced 7-day maturities with effect from 2 May 2007, cf. Danmarks Nationalbank (2007).

Source: Danmarks Nationalbank.

son is difficult due to differences in the monetary-policy instruments used in Denmark and the euro area, respectively.

Much of the volatility in Danish overnight interest rates can be predicted and is attributable to technical aspects relating to the design of the monetary-policy instruments. This means that the overnight interest rate is high on days when Danmarks Nationalbank conducts open market operations, cf. Chapter 4. Previously, 14-day maturities for monetary-policy loans and certificates of deposit meant that large technical fluctuations were sometimes seen in the overnight interest rate as a result of interest-rate speculation in connection with monetary-policy adjustments. Consequently, Danmarks Nationalbank in May 2007 introduced 7-day maturities for its monetary-policy loans and certificates of deposit.

In the euro area, the widest spread between the monetary-policy interest rates and the overnight interest rates is normally seen towards the end of a reserve maintenance period, when the reserve requirement must be met.

Danmarks Nationalbank's target is to keep the krone stable, and it therefore attaches less importance to reducing fluctuations (volatility) in overnight interest rates as this does not affect longer-term money-market interest rates, cf. Andersen (2004). Moreover, the sign of the counterparties' net position is of no monetary-policy significance in Denmark, given the limited spread between the lending rate and the rate of interest on certificates of deposit. This is important since the sign may change from time to time, especially when Danmarks Nationalbank purchases and sells foreign exchange.

2.10 LIQUIDITY MANAGEMENT AND FINANCIAL STABILITY

To ensure financial stability, it is essential for central banks to provide banks with the liquidity they require so that systemic crises are avoided. In Denmark, the objective of ensuring a secure and stable financial system, including safe settlement of payments, is explicitly stated in section 1 of the Danmarks Nationalbank Act ("... to maintain a safe and secure currency system in this country, and to facilitate and regulate the traffic in money and the extension of credit"). Danmarks Nationalbank normally manages liquidity by means of its monetary-policy instruments.

The Financial Stability Forum, which comprises, among others, the ministries of finance, central banks and financial supervisory authorities of the major economies, has conducted an analysis of the factors and the underlying weaknesses in the financial system that led to the outbreak of financial turmoil in the summer of 2007.¹ In its report, it encour-

¹ Cf. Financial Stability Forum (2008a) and the follow-up report Financial Stability Forum (2008b).

ages central banks to ensure that their operational frameworks are sufficiently flexible to address extraordinary situations.

Against the backdrop of the financial turmoil and subsequent financial crisis several central banks have taken a number of extraordinary measures to assure the banks that they will have access to liquidity. The specific measures have varied from country to country depending on the countries' monetary-policy instruments. Besides supporting the availability of liquidity, these measures have been aimed at improving financing opportunities in general, both for the banking system and for selected markets outside the banking system. Central banks have boosted financing opportunities by providing loans and by purchasing securities.

Measures taken include adjustment of the existing range of instruments, e.g. by conducting open market operations more frequently, expanding the lending volume, providing a larger supply of loans with longer maturities, and expanding the collateral base and the group of counterparties who have access to central-bank instruments.¹

In connection with the financial turmoil Denmark's Nationalbank thus expanded its collateral base to facilitate pledging of collateral by monetary-policy counterparties, thereby providing increased access to monetary-policy loans, cf. Box 2.8. The ECB's transition to full allotment at a fixed rate of interest in its weekly main refinancing operations is another example of how existing instruments have been adjusted.

A number of central banks have also supplemented their monetary-policy instruments with new, temporary facilities in order to improve access to liquidity.

In Denmark, a temporary facility has been introduced whereby credit can be granted on the basis of excess capital adequacy. Such credit is subject to a higher rate of interest than monetary-policy loans.

Besides making liquidity more accessible, several of these facilities have also improved the banks' opportunities for finding long-term financing. In December 2007, the Federal Reserve, Fed, introduced a new facility (Term Auction Facility, TAF) whereby it auctions off a given volume of loans at a variable rate of interest for up to 84 days. In addition to its main refinancing operations, the ECB has always conducted open market operations in loans with longer maturities, e.g. three months, for a given volume. During the crisis, the volume in these operations has been increased. In June 2009, the ECB began to conduct one-year fixed-rate refinancing operations with full allotment.

¹ For overviews of the various measures, see Kjærgaard and Risbjerg (2008), Borio and Nelson (2008) and Committee on the Global Financial System (2008).

DANMARKS NATIONALBANK'S TEMPORARY MEASURES IN CONNECTION WITH THE FINANCIAL TURMOIL IN 2008-09¹

Box 2.8

Expansion of the collateral basis for credit facilities from Danmarks Nationalbank

Danmarks Nationalbank has temporarily expanded the collateral basis for borrowing by banks and mortgage-credit institutes from Danmarks Nationalbank (monetary-policy loans and intraday credit) to include a number of new types of securities:

- Quoted shares
- Quoted investment fund shares
- Government-guaranteed bank bonds
- Government-guaranteed junior covered bonds
- Quoted junior covered bonds without a government guarantee
- Unquoted shares
- Loan bills, cf. below.

Secured lending facility

In May 2008, Danmarks Nationalbank established a temporary facility that enabled banks and mortgage-credit institutes to borrow against special loan bills issued by banks in the Kingdom of Denmark.

Each bank or mortgage-credit institute can borrow at Danmarks Nationalbank against acquired loan bills up to a ceiling of 25 per cent of its Tier-1 capital. However, loan bills from a single issuer can only be pledged up to 75 per cent of the issuing institution's Tier-1 capital. Loan bills that are eligible for secured lending at Danmarks Nationalbank can be included in a lending bank's liquidity, cf. Section 152 of the Danish Financial Business Act, until one month before the expiry of the facility.

Originally, the rate of interest applying when pledging loan bills was Danmarks Nationalbank's lending rate plus a premium of 2 percentage points. In the light of falling interest rates, the premium was reduced to 1 percentage point in March 2009. In July 2009, when the collateral base was temporarily expanded to include e.g. unquoted government-guaranteed bank bonds, the premium was abolished.

Credit facility on the basis of excess capital adequacy

Banks and mortgage-credit institutes may borrow at Danmarks Nationalbank on the basis of their excess capital adequacy, i.e. an amount corresponding to the difference between the base capital and the capital need, less a margin of 1 per cent. The maximum credit line is usually kr. 800 million.

Banks and mortgage-credit institutes can provisionally be approved for a credit line based on a statement signed by their management and auditors as to the agreed working tasks. Moreover, they must present a liquidity budget and provide information about their loan development on a monthly basis. If an institution is approved for credit from Danmarks Nationalbank under this facility, it may determine on a weekly basis the amount it wishes to borrow within the credit line. The credit line can be included in the institution's liquidity, cf. Section 152 of the Danish Financial Business Act, until one month before the expiry of the credit line.

Originally, the rate of interest applying when borrowing on the basis of excess capital adequacy was Danmarks Nationalbank's lending rate plus a premium of 2 per cent. In the light of falling interest rates, the premium was reduced to 1 per cent in March 2009.

¹ Danmarks Nationalbank (2008b) and Danmarks Nationalbank's website.

CONTINUED

Box 2.8

Swap lines with the Federal Reserve and the ECB

In connection with the financial turmoil, dollars and euro have been in short supply in many countries. The Federal Reserve has concluded agreements with a number of central banks, including Danmarks Nationalbank, on establishment of temporary reciprocal currency arrangements (swap lines). To facilitate access to short-term financing in euro, Danmarks Nationalbank has concluded a similar agreement with the ECB. Under the swap lines, Danmarks Nationalbank relends dollars and euro to its monetary-policy counterparties. When Danmarks Nationalbank draws on one of the swap lines for financing its lending in dollars or euro, it pays interest directly to the Federal Reserve or the ECB.

Furthermore, the Fed and the ECB have concluded swap agreements with other central banks, including Danmarks Nationalbank, to facilitate access to dollars and euro. Under these agreements, the Fed and the ECB lend dollars and euro, respectively, to other central banks against their national currencies as collateral. The other central banks then relend the dollars and euro.

Some facilities have been aimed at investors and borrowers outside the banking system. For example, the Fed purchases 3-month securities directly from the issuers and lends directly to mutual funds.

The Fed has also introduced lending facilities that provide access to longer-term loans. In order to give households and the corporate sector better access to credit, it has provided loans with maturities of up to 5 years to owners of securities where e.g. consumption loans or corporate loans are applied as collateral.

Finally, the Fed and the ECB have established facilities to purchase long-term bonds in selected markets with a view to facilitating access to credit.

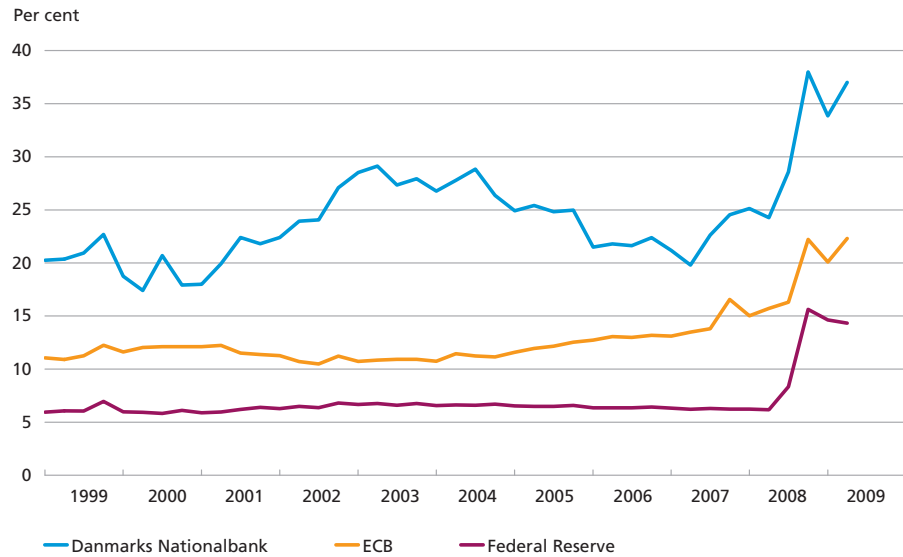
The last time Danmarks Nationalbank was seriously active in the bond market with a view to influencing interest rates was in 1986 when it briefly tried to curb interest-rate increases. With the fixed-exchange-rate policy and free capital flows, intervention in the bond market can no longer be used to influence long-term interest rates in Denmark, which are to a large extent determined by international conditions.

The Fed has introduced securities lending facilities under which government securities are typically offered in exchange for smaller, less liquid securities with a lower credit quality, the aim being to improve the liquidity of these securities.

In several cases, the central banks' increased lending and purchase of securities has substantially increased their balance sheets, cf. Chart 2.10. Danmarks Nationalbank's assets have also grown since mid-2007. This is partly attributable to increased lending, but to a large extent also reflects a larger foreign-exchange reserve, cf. Chapter 3.

CENTRAL-BANK BALANCE SHEETS AND GDP

Chart 2.10



Note: Total assets as a ratio of GDP. Quarterly data. Seasonally adjusted and annualised GDP.
Source: Reuters EcoWin, Federal Reserve, ECB, Statistics Denmark and Danmarks Nationalbank.

2.11 LITERATURE

Abildgren, Kim (2002), Experience with the Eurosystem's Weekly Open Market Operations, Danmarks Nationalbank, *Monetary Review*, 4th Quarter.

Andersen, Allan Bødskov (2004), Volatility in the Overnight Money-Market Rate, Danmarks Nationalbank, *Monetary Review*, 4th Quarter.

Bindseil, Ulrich (2004), *Monetary policy implementation: Theory, past, and present*, Oxford University Press.

Bindseil, Ulrich and Flemming Würtz (2007), Open market operations – their role and specification today. Published in David G. Mayes and Jan Toporowski (ed.), *Open market operations and financial markets*, *Routledge International Studies in Money and Banking*.

Borio, Claudio and William Nelson (2008), Monetary operations and the financial turmoil, BIS, *Quarterly Review*, 1st Quarter.

Carlsen, Maria and Charlotte Franck Fæste (2007), The Pass-Through from Danmarks Nationalbank's Interest Rates to the Banks' Retail Interest Rates, Danmarks Nationalbank, *Monetary Review*, 2nd Quarter.

Carlsen, Maria and Johanne Dinesen Riishøj (2006), Use of cash in Denmark (in Danish only), *Danmarks Nationalbank Working Papers*, No. 41.

Committee on the Global Financial System (2008), Central bank operations in response to the financial turmoil, BIS, *CGFS Papers*, No. 31.

Danmarks Nationalbank (2003), Use of Monetary-Policy Instruments, *Monetary Review*, 1st Quarter.

Danmarks Nationalbank (2004), *Financial Management at Danmarks Nationalbank*.

Danmarks Nationalbank (2005), *Payment Systems in Denmark*.

Danmarks Nationalbank (2007), Change to 7-Day Maturity for Monetary-Policy Loans and Certificates of Deposit, *Monetary Review*, 1st Quarter.

Danmarks Nationalbank (2008a), Recent Economic and Monetary Trends, *Monetary Review*, 4th Quarter.

Danmarks Nationalbank (2008b), The International Financial Crisis, *Monetary Review*, 4th Quarter.

Danmarks Nationalbank (2009a), Liquidity management in Denmark (in Danish only), www.nationalbanken.dk.

Danmarks Nationalbank (2009b), *Financial stability*, 1st Half 2009.

ECB (2004), *The monetary policy of the ECB*.

ECB (2008a), *Monthly Bulletin 10th Anniversary of the ECB*.

ECB (2008b), *The implementation of monetary policy in the euro area*.

Financial Stability Forum (2008a), *Report on enhancing market and institutional resilience*, 7 April.

Financial Stability Forum (2008b), *Report on Enhancing Market and Institutional Resilience. Follow-up on Implementation*, 10 October.

Forssbæck, Jens and Lars Oxelheim (2007), Money market development and policy operations. Published in David G. Mayes and Jan Toporwski (ed.), Open market operations and financial markets, *Routledge International Studies in Money and Banking*.

Goodhart, Charles (1985), *The evolution of central banks*, London School of Economics and Political Science.

Kjærgaard, Morten and Lars Risbjerg (2008), Financial Turmoil, Liquidity and Central Banks, Danmarks Nationalbank, *Monetary Review*, 1st Quarter.

Kran, Lars-Christian (2001), Norges Bank's system for managing interest rates, Norges Bank, *Economic Bulletin*, 2nd Quarter.

Market Committee (2009), *Monetary policy frameworks and central bank market operations*, BIS, May.

Mayes, David G. and Jan Toporwski (2007), Open market operations and financial markets, *Routledge International Studies in Money and Banking*.

Pedersen, Anders Mølgaard (2009), Pledging of collateral for credit facilities from central banks (in Danish only), *Finans/Invest*, No. 2.

Pedersen, Erik Haller and Tom Wagener (2000), Compilation of Seigniorage, Danmarks Nationalbank, *Monetary Review*, 4th Quarter.

Tucker, Paul (2004), Managing the central bank's balance sheet: Where monetary policy meets financial stability, Bank of England, *Quarterly Bulletin*, Vol. 44, No. 3.

Woodford, Michael (2001), Monetary policy in the information economy. Published in Federal Reserve Bank of Kansas City, *Symposium Proceedings: Economic Policy for the Information Economy*.

CHAPTER 3

Exchange Rate of the Krone, Foreign-Exchange Market and Capital Flows

SUMMARY

Denmark conducts a fixed-exchange-rate policy vis-à-vis the euro. Consequently, monetary and foreign-exchange policy is aimed at keeping the krone stable against the euro. Other considerations than the exchange rate are not considered in relation to monetary policy, and Danmarks Nationalbank's monetary-policy interest rates are used solely to manage the krone rate.

The krone rate is formed in the foreign-exchange market, which thus plays an important role in monetary and foreign-exchange policy. The krone rate is determined by the supply of and demand for kroner in the foreign-exchange market. Part of the activity in the foreign-exchange market is related to cross-border trade in goods and services, but the largest share is attributable to cross-border capital flows entailing purchase and sale of foreign exchange. Capital flows into Denmark, and thus more pronounced demand for kroner, normally cause the krone to strengthen, and vice versa in case of capital outflows.

In the short term, Danmarks Nationalbank can keep the krone stable by buying and selling foreign exchange in the market. When Danmarks Nationalbank buys kroner against euro, the krone tends to strengthen, all other things being equal. When Danmarks Nationalbank sells kroner against euro, the krone tends to weaken. Danmarks Nationalbank intervenes in the foreign-exchange market by trading foreign exchange with a number of major Danish and foreign dealers.

In periods of calm foreign-exchange markets, Danmarks Nationalbank usually mirrors the ECB's interest-rate changes. In situations with persistent inflows or outflows of foreign exchange and pressure on the krone, Danmarks Nationalbank changes its interest rates unilaterally to keep the krone stable. The monetary-policy interest rates govern the money-market interest rates, which influence capital flows and the exchange rate.

The participants in the foreign-exchange market for Danish kroner are usually able to handle transactions in connection with capital flows among themselves without any significant impact on the krone rate and

thus without intervention by Danmarks Nationalbank. In addition, the market participants themselves contribute to stabilising the krone by taking positions on the basis of their expectations of a stable krone rate. This reflects confidence in the fixed-exchange-rate policy as well as its credibility.

3.1 THE FIXED-EXCHANGE-RATE POLICY

Denmark has pursued a consistent fixed-exchange-rate policy since the early 1980s. Monetary policy is aimed at keeping the krone stable vis-à-vis the euro, and other considerations than the exchange rate – e.g. economic developments in Denmark – are not considered in relation to monetary policy. Prior to the introduction of the euro at the beginning of 1999, Denmark's fixed-exchange-rate policy was oriented towards the D-mark.¹

The main objective of monetary policy in the euro area is to maintain an inflation rate of below, but close to, 2 per cent. By keeping the krone stable against the euro, a basis for low inflation is also created in Denmark in the slightly longer term. The formal framework for Denmark's fixed-exchange-rate policy is the European Exchange Rate Mechanism, ERM II, cf. Box 3.1. Denmark participates at a central rate of 7.46038 kroner per euro and a fluctuation band of +/- 2.25 per cent. Formally, ERM II participation only implies that the krone must be kept within the fluctuation band, but since 1997 Danmarks Nationalbank has kept the krone close to its central rate, cf. Chart 3.1.

In the short term, Danmarks Nationalbank can influence the krone rate by intervening in the foreign-exchange market, i.e. by buying or selling kroner against foreign exchange. When the krone is weakening, Danmarks Nationalbank buys kroner and sells foreign exchange in order to counteract this tendency. Conversely, Danmarks Nationalbank sells kroner and buys foreign exchange to curb a strengthening of the krone. Chart 3.2 shows the development in the krone rate and interventions.

Danmarks Nationalbank can adjust its monetary-policy interest rates at any time if warranted by the krone rate. In periods of calm foreign-exchange markets, Danmarks Nationalbank usually changes its interest rates when the European Central Bank, ECB, changes its key interest rate. Before the introduction of the euro at the beginning of 1999, the spread between monetary-policy interest rates in Denmark and Germany was central to Denmark's monetary policy and the krone rate.

¹ The following EU member states introduced the euro as from 1 January 1999: Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain. Greece joined the euro area with effect from 1 January 2001. Slovenia became a member on 1 January 2007, Cyprus and Malta on 1 January 2008 and Slovakia on 1 January 2009.

THE EUROPEAN EXCHANGE-RATE MECHANISM, ERM II

Box 3.1

Since 1 January 1999, which marked the introduction of Stage Three of Economic and Monetary Union, EMU, Denmark has participated in the European Exchange Rate Mechanism II, ERM II, which replaced the ERM under the European Monetary System, EMS.¹

In ERM II, a bilateral central rate vis-à-vis the euro is fixed for the currency of each participating country. Each currency has an initial fluctuation band of +/- 15 per cent around its central rate against the euro², but narrower fluctuation bands may be negotiated under ERM II.

If a participating currency reaches one of the fluctuation limits in ERM II, both the ECB and the relevant central bank must keep the currency within the fluctuation band by buying the weak and selling the strong currency. When intervening at the fluctuation limits, the ECB and the relevant central bank grant each other unlimited intervention credit with an initial maturity of up to three months.³ This credit is remunerated and may be extended. The ECB and the relevant central bank may suspend the intervention if it is in conflict with maintaining price stability. However, this has never occurred in practice.⁴

ERM II provides for adjustment of the central rates. Decisions on central rates and the standard fluctuation band require agreement between the ministers from the euro area member states, the ECB and the ministers and central-bank governors from the non-euro area member states participating in ERM II. The foundation of ERM II is that exchange-rate adjustments are only needed in exceptional cases. This requires a generally responsible economic policy, including fiscal policy, that is consistent with the exchange-rate relations agreed.

Denmark participates in ERM II at a central rate of 7.46038 kroner per euro. The central rate is a conversion of the central rate of the krone against the D-mark in ERM. The last adjustment in ERM took place on 12 January 1987. Owing to the high degree of economic convergence with the euro area as a result of a persistently stability-oriented economic policy, Denmark was able to conclude an agreement on a narrow fluctuation band of +/- 2.25 per cent.⁵

Denmark was the only member state participating in ERM II in 2001-04. After the EU enlargement in 2004, several member states have participated in ERM II for a period before introducing the euro. According to the Treaty, one of the convergence criteria for euro area membership is "... the observance of the normal fluctuation margins provided for by the exchange-rate mechanism of the European Monetary System, for at least two years, without devaluing against the currency of any other Member State"⁶. The current participants in ERM II are Denmark, Estonia, Latvia and Lithuania.

¹ The most important principles and provisions for ERM II appear from a resolution from the European Council in Amsterdam in June 1997, the communiqué of the informal meeting of the Ecofin Council on 25-27 September 1998 in Vienna between the ministers of finance and economic affairs and central-bank governors of the EU member states, as well as the agreement of 1 September 1998 (as amended) between the ECB and the non-euro-area EU central banks.

² The euro is thus at the centre of ERM II, because the participating member states have central rates vis-à-vis the euro, not vis-à-vis each other as they had in ERM, which was in force before Stage Three of Economic and Monetary Union.

³ In principle, the very short-term credit facility is automatic and unlimited, applying to financing of intervention at the fluctuation limits. The debtor central bank should make suitable use of its own foreign-exchange reserve before drawing on the facility. In general, intervention should be used as a supporting measure together with other policy measures, including suitable use of the interest-rate policy.

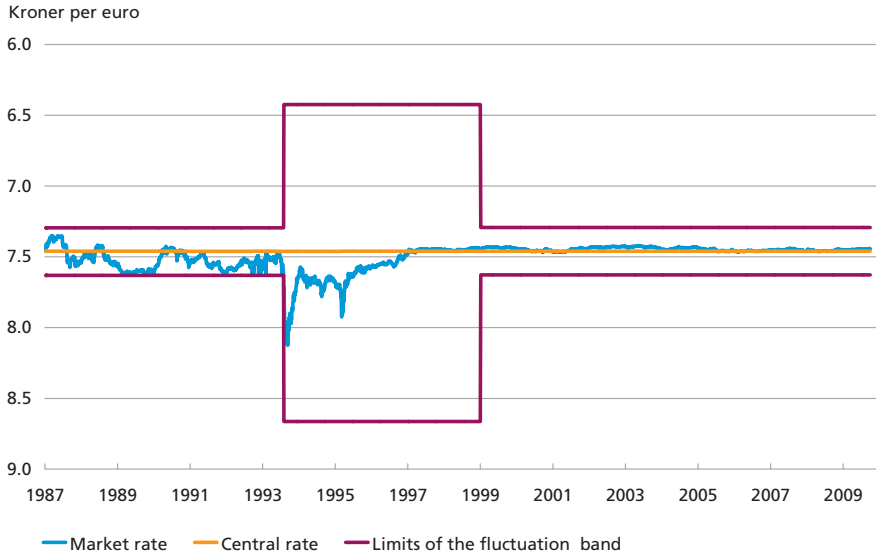
⁴ The historical background to the provision is described in Hoffmeyer (1992).

⁵ Cf. the communiqué of the informal meeting of the Ecofin Council on 25-27 September 1998, printed on p. 21 of Danmarks Nationalbank, *Monetary Review*, 4th Quarter 1998.

⁶ Article 121 of the EC Treaty.

EXCHANGE RATE OF THE KRONE AGAINST THE EURO

Chart 3.1



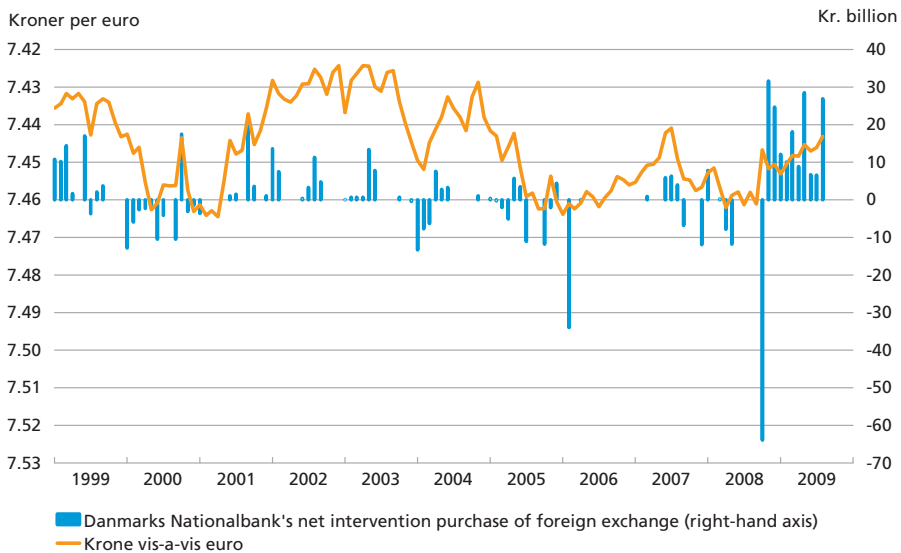
Note: Reverse scale. Before 1999 a synthetic exchange rate for the krone vis-à-vis the euro, calculated on the basis of the krone rate against the D-mark and the irrevocably locked conversion rate between the euro and the D-mark on 1 January 1999, has been applied.

Source: Danmarks Nationalbank.

If the krone has been weakening and Danmarks Nationalbank has regularly been selling foreign exchange for a relatively long period, Danmarks Nationalbank will unilaterally raise its monetary-policy interest

KRONE RATE AND DANMARKS NATIONALBANK'S INTERVENTIONS

Chart 3.2



Note: Left-hand axis (krone rate): reverse scale. The krone rate is at month-end. Right-hand axis: interventions are on a monthly basis accrued by value date.

Source: Danmarks Nationalbank.

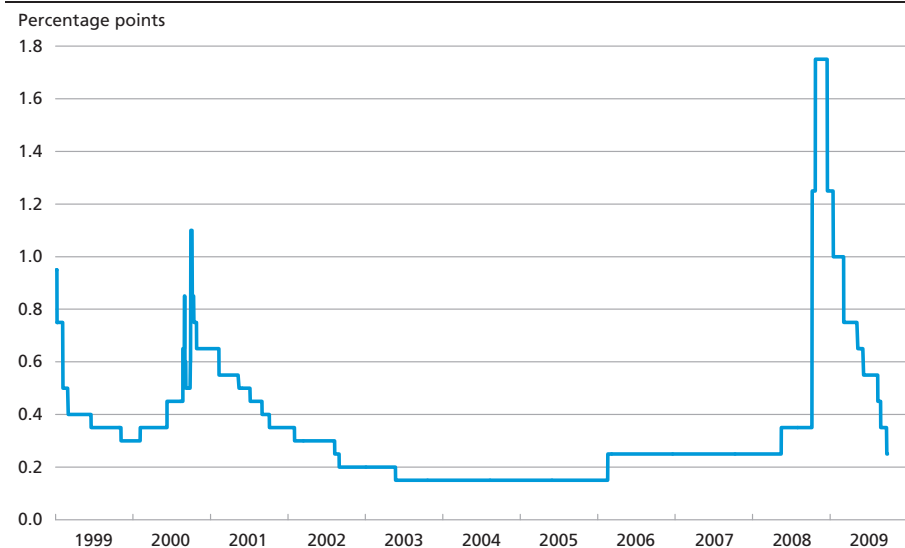
rates in relation to those of the ECB. The krone tends to strengthen when Danmarks Nationalbank tightens monetary policy, thereby widening the spread between monetary-policy interest rates in Denmark and the euro area. The strengthening can be attributed to stronger demand for kroner as it becomes more attractive to place funds in kroner and more expensive to borrow in kroner.

Conversely, Danmarks Nationalbank will narrow the spread between monetary-policy interest rates in Denmark and the euro area when the krone is strengthening and Danmarks Nationalbank has been buying foreign exchange for a relatively long period. When monetary policy is eased, the krone tends to weaken. The reason is that demand for kroner decreases since a narrowing of the interest-rate spread between Denmark and the euro area makes it more attractive to place funds in the euro area and less expensive to borrow in kroner.

Chart 3.3 shows the spread between monetary-policy interest rates in Denmark and the euro area. The Chart illustrates the widening of the spread in situations with unrest or uncertainty in the foreign-exchange markets, e.g. in the periods around 2000 and 2008, and the subsequent gradual narrowing when the unrest has subsided.

SPREAD BETWEEN MONETARY-POLICY INTEREST RATES IN DENMARK AND THE EURO AREA

Chart 3.3



Note: For Denmark, Danmarks Nationalbank's lending rate has been applied for the entire period. For the euro area, the ECB's fixed tender rate has been used from 1999 to end-June 2000. The ECB's minimum bid rate has then been used until 14 October 2008, after which time the fixed interest rate on the Eurosystem's main refinancing operations has been used.

Source: Deutsche Bundesbank, ECB and Danmarks Nationalbank.

In periods with calm foreign-exchange markets, it can be observed that the market participants take positions based on expectations of a stable krone rate. This helps to stabilise the krone. For example, the banks may increase their foreign-exchange holdings when the krone strengthens against the euro. This may be attributable to the banks buying euro and selling kroner when the krone strengthens, expecting the krone to weaken subsequently, which will represent a profit opportunity. The banks' sales of kroner will as such contribute to a weakening of the krone, thus dampening the fluctuations. In this way, the market participants support the fixed-exchange-rate policy.

Conversely, in periods of unrest the market participants may amplify the fluctuations in the krone rate if they speculate against the krone. However, experience shows that during a currency crisis it is generally the banks' customers, and not the banks themselves, who take positions against the krone.

3.2 DANMARKS NATIONALBANK'S USE OF INTERVENTION AND CHANGES IN INTEREST-RATES

The instruments of intervention and interest-rate changes can, in principle, be used separately.

If the krone tends to weaken or strengthen, Danmarks Nationalbank will normally, as a first step, only choose to intervene in the foreign-exchange market. The main purpose of isolated intervention is to counter minor or temporary fluctuations in the krone rate. Generally, however, the foreign-exchange market functions without intervention by Danmarks Nationalbank, and most interventions are for small amounts.

In the event of more persistent inflows or outflows of foreign exchange – without actual pressure on the krone – the intervention will usually be supplemented with minor interest-rate changes, e.g. in the range of 0.05-0.1 percentage point. When Danmarks Nationalbank unilaterally raises (lowers) interest rates, the spread between monetary-policy interest rates in Denmark and the euro area widens (narrows). If substantial outflows of foreign exchange persist and the krone is under pressure, Danmarks Nationalbank will normally have to raise interest rates more significantly, e.g. by 0.25 or 0.5 percentage point, besides the intervention. Speculative attacks against the krone could warrant considerably more pronounced interest-rate increases and intervention for major amounts.

In certain cases of short-lived currency unrest Danmarks Nationalbank has chosen to raise the lending rate and the rate of interest on certificates of deposit without raising the current-account rate and the dis-

count rate. This affects money-market interest rates in particular, while the banks' retail interest rates are to a certain extent shielded. Moreover, money-market interest rates often rise strongly in periods of currency unrest, which makes speculation more expensive and contributes to keeping the krone stable.

Box 3.2 describes a specific situation from the autumn of 2008 when Danmarks Nationalbank used intervention and interest-rate changes as instruments to manage the krone rate.

DANMARKS NATIONALBANK'S USE OF INTERVENTION AND INTEREST-RATE CHANGES

Box 3.2

The international financial crisis, which began in the summer of 2007, escalated during the autumn of 2008. The Danish krone weakened in September and October 2008 after a period with a negative spread between Danmarks Nationalbank's lending rate and the ECB's allotment rate, cf. Chart 3.4 (left). The reason for the negative spread was stronger demand from credit institutions in the euro area for liquidity in the ECB's weekly tenders, which led to an increase in the ECB's interest rate to a high level.¹ Another factor contributing to the pressure on the krone was the tendency for investors to withdraw from minor currencies, including the Danish krone, as a result of the intensified financial crisis.

To stabilise the krone, Danmarks Nationalbank intervened in the foreign-exchange market, buying kroner against foreign exchange for a considerable amount from late September to early October 2008. However, this proved insufficient to withstand the pressure on the krone, and in accordance with the fixed-exchange-rate policy Danmarks Nationalbank unilaterally raised its monetary-policy interest rates, whereby the spread to the euro area widened. With effect from 8 October 2008, the lending rate and the rate of interest on certificates of deposit were raised by 0.4 percentage point. The discount rate and the current-account rate were raised by 0.25 percentage point. Danmarks Nationalbank continued to intervene in the foreign-exchange market after the interest-rate increase. At midday on 8 October, the ECB announced its decision to lower interest rates by 0.5 percentage point, citing the intensifying financial crisis as the background.² Consequently, the spread between Danmarks Nationalbank's lending rate and the ECB's allotment rate widened further since Danmarks Nationalbank maintained its monetary-policy interest rates.

Despite this widening, the krone was still under pressure due to the outflow of foreign exchange. This prompted Danmarks Nationalbank to intervene again at the end of October, buying kroner against foreign exchange to stabilise the krone. The (net) intervention in October totalled kr. 64 billion, cf. Chart 3.4 (right). In addition, Danmarks Nationalbank contributed to mitigating the shortage of foreign exchange among Danish banks by selling foreign exchange via FX swaps for around kr. 10 billion. On 24 October, Danmarks Nationalbank raised the lending rate and the rate of interest on certificates of deposit by a further 0.5 percentage point, thus widening the spread to the ECB's interest rate to 1.75 percentage points.

¹ Prior to 8 October 2008, the ECB conducted weekly main refinancing operations through a variable-rate tender procedure and after 8 October through a fixed-rate tender procedure. The change was announced on 8 October, with effect from the main refinancing operation settled on 15 October 2008.

² A coordinated global interest-rate reduction by several central banks.

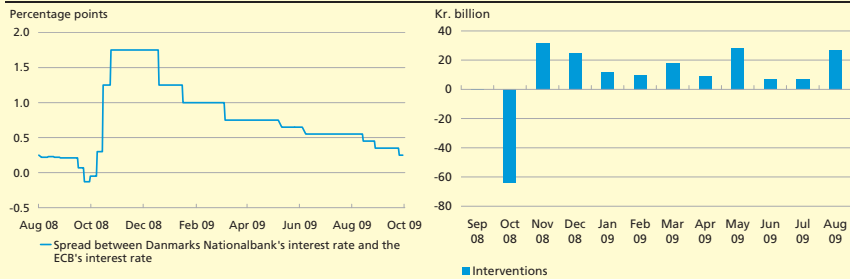
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Boks 3.2

The krone strengthened again from the end of October, and Danmarks Nationalbank was able to buy back foreign exchange over the subsequent months. This enabled Danmarks Nationalbank gradually to reduce its monetary-policy interest rates again, thus narrowing the spread to the ECB.

INTEREST-RATE SPREAD AND INTERVENTIONS

Chart 3.4



Note: Left: The ECB's interest rate is the variable allotment rate (the marginal rate on the ECB's main refinancing operations) until 14 October 2008, after which time the fixed allotment rate has been used. Right: Danmarks Nationalbank's net purchases of foreign exchange for intervention purposes, calculated on settlement days.

Source: Danmarks Nationalbank and ECB.

The foreign-exchange reserve

Danmarks Nationalbank's foreign-exchange reserve serves as a contingency fund for intervention in the foreign-exchange market. In addition, the size of the foreign-exchange reserve is a signal that can contribute to dampening speculation in advance.

The foreign-exchange reserve is thus an important element of Denmark's fixed-exchange-rate policy. When Danmarks Nationalbank sells foreign exchange and buys kroner, the foreign-exchange reserve shrinks. On the other hand, the foreign-exchange reserve grows when Danmarks Nationalbank buys foreign exchange and sells kroner.

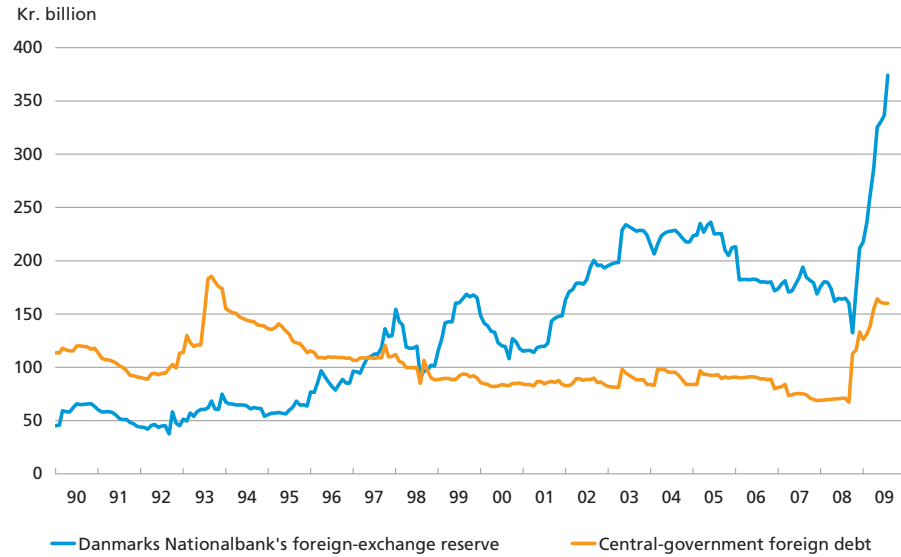
The foreign-exchange reserve consists of secure and liquid assets, mainly in the form of deposits with foreign banks and foreign securities that can rapidly be sold or pledged as collateral, should the need arise.¹ In the light of the fixed-exchange-rate policy, the foreign-exchange reserve is primarily in euro.

Changes in the foreign-exchange reserve are mainly attributable to two factors: Danmarks Nationalbank's purchases and sales of foreign exchange, and central-government foreign borrowing. To this should be added value adjustment of the foreign-exchange reserve as a result of fluctuations in market value and exchange rates. There are no fixed

¹ The foreign-exchange reserve is described in more detail in Jensen (1999) and Danmarks Nationalbank (2004).

 THE FOREIGN-EXCHANGE RESERVE AND CENTRAL-GOVERNMENT
 FOREIGN DEBT

Chart 3.5



Note: Monthly data. Central-government foreign debt comprises the central-government debt in foreign exchange.
 Source: Danmarks Nationalbank.

rules concerning the size of the foreign-exchange reserve. The suitable level depends on the market conditions.

The government and Danmarks Nationalbank have agreed that the objective of central-government foreign borrowing is to maintain an adequate foreign-exchange reserve.¹ In periods with a strong decline in the foreign-exchange reserve due to intervention to support the krone, the central government has normally raised loans in foreign exchange to strengthen the foreign-exchange reserve. In calmer periods, Danmarks Nationalbank has been able to buy foreign exchange. Chart 3.5 shows the course of the foreign-exchange reserve and the central government's foreign debt since 1990.

The development during the financial crisis in the autumn of 2008, when the Danish krone came under pressure, showed that considerable purchases of kroner may sometimes be needed to support the exchange rate. Besides interventions for considerable amounts, Danmarks Nationalbank also raised its interest rates. At that time, the market was characterised by pronounced risk aversion, which dampened the effect of an interest-rate increase compared with normal circumstances. Given this experience, the foreign-exchange reserve was expanded as from the end of 2008 to ensure sufficient contingency funds to maintain the fixed-

¹ Funding rules for central-government borrowing. See also Danmarks Nationalbank (2008).

exchange-rate policy vis-à-vis the euro. The expansion was effected partly through central-government borrowing in foreign exchange, partly through Danmarks Nationalbank's purchases of foreign exchange which were possible under the given market conditions.

3.3 THE FOREIGN-EXCHANGE MARKET FOR DANISH KRONER

The foreign-exchange market for Danish kroner (the krone market) is the market for purchase and sale of foreign exchange against Danish kroner.¹ All transactions involving transfer of a position in Danish kroner against foreign exchange from one market participant to another are part of the krone market. The exchange rate of the krone is formed in the krone market, which thus plays an important role in monetary and foreign-exchange policy.

Products in the krone market

Trading in the krone market primarily comprises spot transactions, forward contracts and foreign-exchange swaps (FX swaps).

Spot transactions are foreign-exchange transactions (purchase and sale of foreign exchange against Danish kroner) for settlement not later than two banking days after the conclusion of the contract. A spot transaction is the simplest product. It is used for simple conversion between kroner and foreign exchange. For example, an export company with revenue in dollars and expenditure in kroner may wish to sell its dollar revenue in return for Danish kroner.

Forward contracts are foreign-exchange transactions for settlement later than two banking days after the trade date. Forward contracts may be used by companies to hedge the exchange-rate risk associated with their transactions. If an export company knows that it will receive dollars e.g. in a year's time, it can sell its future dollar revenue forward in order to fix its revenue's value in kroner in advance, cf. the example in Box 3.3. The company can thus immunise itself against exchange-rate fluctuations. Likewise, non-residents holding krone-denominated bonds can hedge their positions by forward sale of their future krone-denominated payments from the bonds. In addition, forward contracts are used for speculation in interest-rate spreads and exchange-rate fluctuations.

FX swaps comprise a spot trade combined with an opposite forward contract. On settlement of the spot trade, one currency is exchanged for another, and vice versa on settlement of the forward contract. However, FX swaps with one leg in kroner should be seen much more as a money-

¹ The krone market is described in more detail in Abildgren (2006) and Egstrup and Fischer (2007).

EXAMPLE OF A FORWARD CONTRACT

Box 3.3

A forward foreign-exchange contract is a contract between two parties for the exchange of payments in foreign exchange at a fixed time in the future at a rate agreed beforehand (forward rate). Forward contracts can therefore be used to hedge the exchange-rate risk on known future exposures in foreign exchange. If an export company knows that e.g. in a year's time it will receive 100 dollars, it can hedge the exchange-rate risk on the revenue by selling dollars against kroner one year forward. Consequently, the company will know the value in kroner of the future revenue already today.

The company concludes the forward contract with its bank. The bank commits to receiving 100 dollars in one year against payment in one year of the 1-year forward rate fixed today, $F_{\text{DKK/USD}}$. According to the covered interest-rate parity, the forward rate, calculated as the spot rate plus a forward premium, can be approximated as follows:

$$F_{\text{DKK/USD}} = S_{\text{DKK/USD}} + S_{\text{DKK/USD}} \cdot (r_{\text{DKK}} - r_{\text{USD}}),$$

where $S_{\text{DKK/USD}}$ is the spot rate (kroner per dollar) and interest rates on loans in kroner and dollars, respectively, are r_{DKK} and r_{USD} . Assume that $S_{\text{DKK/USD}} = 550$ kroner per 100 dollars, 1-year $r_{\text{DKK}} = 2$ per cent and 1-year $r_{\text{USD}} = 1.5$ per cent. The forward rate can then be calculated as:

$$F_{\text{DKK/USD}} = 550 + 550 \cdot (0.02 - 0.015) = 552.75 \text{ kroner per 100 dollars.}$$

The forward premium here is 2.75 kroner per 100 dollars. The forward premium reflects the interest-rate spread between Denmark and the USA. The premium is positive when interest rates are higher in Denmark than in the USA. A negative forward premium is called a forward discount.

The company in the example now knows the value of its future revenue. In one year, the company will pay 100 dollars to the bank, which will pay 552.75 kroner to the company.

market product than a foreign-exchange-market product since the purpose is often to raise or lend krone-denominated liquidity for a short period against foreign exchange (typically dollars) as collateral, cf. also Chapter 4.

The various types of foreign-exchange transactions affect the krone rate in different ways. The three most frequently used products in the krone market and how they affect the krone rate are described in Box 3.4.

In addition, foreign-exchange options and (cross) currency swaps are also traded in the krone market, but to a lesser extent. Foreign-exchange options are transactions giving one of the parties the right, but not the obligation, at a fixed time in the future to purchase or sell an amount in one currency against an amount in another currency at an agreed rate. Currency swaps involve ongoing exchange of interest payments and ex-

**THE MOST FREQUENTLY TRADED PRODUCTS IN THE KRONE MARKET
AND THEIR EFFECT ON THE KRONE RATE**

Box 3.4

The initial impact of foreign-exchange transactions on the exchange rate of the krone depends on the transaction type. The three most frequently used products in the krone market are spot transactions, forward transactions and FX swaps.

Spot trading of Danish kroner against another currency has an immediate impact on the krone rate.

With forward transactions, i.e. when Danish kroner are purchased or sold for delivery on a future date, the effect on the exchange rate is usually also observed immediately, since the banks typically hedge forward transactions via spot transactions. If a customer concludes an agreement with a bank to purchase Danish kroner for delivery on a future date against payment in another currency, the bank usually purchases the Danish kroner immediately at the current exchange rate, whereby the exchange-rate risk is eliminated.

In contrast, an FX swap does not affect the exchange rate of the krone since an FX swap corresponds to a spot transaction with an opposite forward transaction – for example, a client buys kroner spot from and at the same time sells kroner forward to a bank. All other things being equal, the purchase of kroner strengthens the krone. The forward sale of kroner is hedged by the bank via the immediate sale of kroner, and, all other things being equal, this weakens the krone. The net impact on the exchange rate is thus zero.

change of principals in different currencies at the beginning and end of the contract term. A currency swap can thus be seen as an exchange of loans in different currencies.

The participants in the krone market

In broad terms, the participants in the krone market can generally be divided into customers, foreign-exchange dealers and brokers and Denmark's Nationalbank.

Customers are typically private companies that need to buy and sell foreign exchange in connection with payments to and from abroad, or institutional investors purchasing and selling securities across national borders. Local authorities and public enterprises may also have large payments to and from abroad.¹

Foreign-exchange dealers are banks that purchase and sell foreign exchange for their customers and trade on their own account. A number of banks have concluded agreements to act as market makers in the krone market, cf. Box 3.5. Market makers have an obligation to quote binding two-way prices vis-à-vis each other within fixed maximum bid/ask spreads and for certain amounts.

¹ Disregarding private individuals, who normally only use the foreign-exchange market in connection with the purchase or sale of travel currency, card payments via the Internet or direct purchase or sale of foreign securities. Private individuals thus play only a minor role in the foreign-exchange market.

MARKET MAKING IN THE KRONE MARKET

Box 3.5

Around 10 banks have concluded mutual market-making agreements. Under the agreements, the banks have an obligation to quote binding two-way prices vis-à-vis each other within fixed maximum bid/ask spreads and for certain amounts.

Spot-market agreements are typically fixed for one year at a time and apply on calm days. On days with turmoil, market makers typically enter into new short-term agreements with a larger bid/ask spread. The difference between the maximum bid and ask prices which can be quoted by the market makers is usually kr. 0.05 per 100 euro (5 pips) in the market-maker agreement for euro spot transactions. The amounts to which the banks commit themselves under the agreements vary from bank to bank. During the last few years each bank has typically committed itself for 10-30 million euro.

For forward contracts and FX swaps there are only market-maker agreements between the banks for dollar transactions. In periods of volatility in the foreign-exchange market, the market participants usually also enter into market-making agreements in foreign-exchange options on dollars.

Besides the direct participants in the krone market there are also brokers who act as intermediaries between buyers and sellers (banks) without themselves being a party to the transactions. Intermediation is subject to a product-specific fee, which may be negotiable. There are a few local brokers in the domestic krone market, but Danish kroner can also be traded via foreign brokers in e.g. Frankfurt, London and Luxembourg.

Danmarks Nationalbank's central role in the krone market is to conduct intervention. Danmarks Nationalbank intervenes by trading foreign exchange with the banks.¹ Moreover, Danmarks Nationalbank also purchases and sells kroner against foreign exchange since it is banker to the central government and in this capacity undertakes payments relating to government debt and other central-government transactions in foreign exchange.

On a daily basis, Danmarks Nationalbank publishes information on the exchange rate of the Danish krone vis-à-vis a number of other currencies.²

Trading in the krone market

In the foreign-exchange market, a broad distinction can be drawn between stock-exchange trading and OTC (Over-The-Counter) trading. Trading in the krone market solely takes place OTC, either in the inter-

¹ Danmarks Nationalbank's counterparties in foreign-exchange transactions in Danish kroner are determined in accordance with the market conditions. The requirements of significant market activity under the given foreign-exchange conditions and capacity for handling payments via SWIFT (Society for Worldwide Interbank Financial Telecommunication) form the basis for the choice of counterparties. If the krone rate reaches one of the two ERM II fluctuation limits, the number of counterparties may be extended.

² The exchange rates are published solely for information purposes and are available at www.nationalbanken.dk.

SETTLEMENT OF FOREIGN-EXCHANGE TRANSACTIONS IN KRONER¹

Box 3.6

When a foreign-exchange transaction has been concluded, it is settled via two opposite payments between the parties. In the foreign-exchange market, settlement takes place via correspondent banks or via CLS (Continuous Linked Settlement).² Transactions in the krone market are generally settled two banking days after the trading day.³

On settlement via a correspondent bank, the currencies traded are normally transferred via banks in their home countries. For example, krone-euro transactions are settled via banks in Denmark and the euro area. All foreign-exchange dealers have a network of correspondent banks with foreign-exchange accounts in various countries. In practice, the parties independently submit payment instructions to their correspondent banks, requesting them to transfer the amount in question to the counterparty's account with its correspondent bank.

Recent years have seen focus on settlement via correspondent banks, which entails a risk of loss of the entire amount purchased in foreign exchange since the counterparty may not submit its payment instruction and execute payment in the event of e.g. liquidity problems or winding-up. CLS was established in September 2002 as a system for payment-versus-payment settlement of foreign-exchange transactions. The system ensures that both parties to a foreign-exchange transaction have paid in their respective amounts to CLS before payments are exchanged.

At present 17 different currencies can be settled via CLS, including Danish kroner, which joined CLS in September 2003. The use of CLS reduces the settlement risk in international foreign-exchange trading, and the participants save considerable amounts of liquidity as pay-ins to CLS take place on a net basis. The concentration of global foreign-exchange settlement in CLS has, however, led to concentration of operational risk. Consequently, the CLS system has been further enhanced to stem the remaining risks.⁴

CLS was established as a bank owned by around 70 of the world's largest private banks. Several participants in the Danish foreign-exchange market use CLS for settlement of a considerable share of their trading. The major Danish banks are direct participants, but there is a large number of indirect participants. In 2008, Danmarks Nationalbank also joined CLS as an indirect participant. Indirect participants report and settle their foreign-exchange transactions via direct participants. Only CLS shareholders can join as direct members.

¹ Settlement of foreign-exchange transactions is described in more detail in Natorp and Sørensen (2006).

² CLS is also described in Danmarks Nationalbank (2003) and Sørensen (2008).

³ T+2 settlement. However, in CLS foreign-exchange transactions can be settled already the banking day after concluding the transaction (T+1).

⁴ For example, actual CLS settlement is protected against system failure by mirrored real-time operations in London and New York, providing for immediate switch between the two. In addition, a new backup operations centre was opened in 2007.

bank or the customer market. The interbank market comprises internal trading among foreign-exchange dealers, while the customer market comprises the foreign-exchange dealers' transactions with customers.

In practice, foreign-exchange transactions take place directly by telephone, via electronic systems or via a voice broker¹. Danmarks Nationalbank may intervene via all three trading channels.

¹ Trading via a voice broker entails that the market participants supply a broker with prices and amounts. On an ongoing basis, the broker states the best bid/ask prices and amounts in the market via a voice system. A market participant can accept a trade by submitting a reply to the broker, who will then establish contact between the parties.

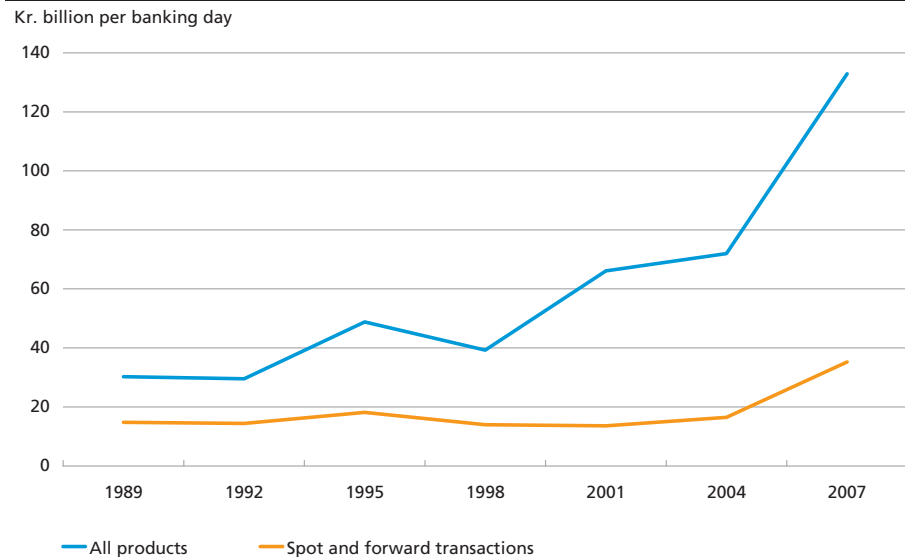
Foreign-exchange transactions are settled via correspondent banks or via the international system for foreign-exchange settlement, Continuous Linked Settlement, CLS, cf. Box 3.6.

Turnover in the krone market

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 was conducted in April 2007. The average turnover per banking day in the domestic krone market – i.e. foreign-exchange turnover in Danish kroner involving a bank located in Denmark – rose from kr. 30 billion per banking day in April 1989 to kr. 133 billion per banking day in 2007, cf. Chart 3.6. A significant part of the increase can be attributed to FX swaps, which should be regarded mainly as a money-market product, as mentioned. Turnover in spot transactions and forward contracts has followed a considerably more moderate course despite the marked increase in payments between Denmark and abroad in this period. This should be viewed in the light of more subdued fluctuations in the krone rate vis-à-vis the D-mark and since 1999 the euro, which has reduced the need for hedging exchange-rate risks, all other things being equal. Moreover, the latter has contributed to very modest turnover of currency swaps and foreign-exchange options in kroner.

TURNOVER IN THE DANISH KRONE MARKET 1989-2007

Chart 3.6



Note: Average daily turnover in April of the relevant years. Turnover in spot and forward transactions in 1989 is partially based on estimates.

Source: BIS and Danmarks Nationalbank.

AVERAGE DAILY TURNOVER IN THE KRONE MARKET, APRIL 2007 Table 3.1

	Denmark		Global	
	Kr. billion per banking day	Per cent	Kr. billion per banking day	Per cent
Spot transactions	21.1	16	33.2	21
Forward transactions	14.2	11	15.7	10
FX swaps	95.9	72	103.5	67
Currency swaps	0.8	1	1.0	1
Foreign-exchange options	0.9	1	1.0	1
Total	132.9	100	154.2	100

Source: BIS and Danmarks Nationalbank.

Danish kroner are not necessarily traded via banks located in Denmark. The global krone market comprises foreign-exchange transactions in Danish kroner involving banks located either in Denmark or abroad. Turnover in the global krone market was kr. 154 billion per banking day in April 2007, cf. Table 3.1.

This means that around 15 per cent of the turnover in kroner in the foreign-exchange market does not pass through banks located in Denmark. Examples are a foreign-exchange transaction in kroner between a German bank and a German investor in Danish bonds, or a foreign-exchange transaction in kroner between a German bank and a German company importing goods from Denmark.

3.4 CAPITAL FLOWS, KRONE RATE AND INTERVENTION

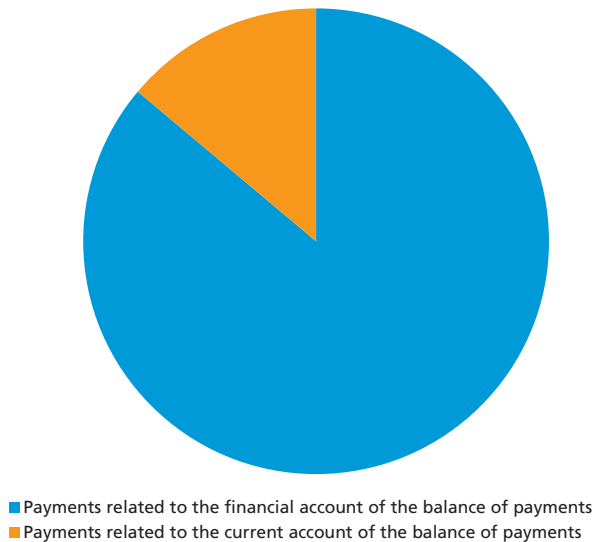
In the long term, exchange rates basically depend on macroeconomic conditions, including economic policy, cf. Chapter 1. The krone is stable against the euro due to the fixed-exchange-rate policy. In practice, the krone fluctuates around its central rate, thus mirroring the euro's fluctuations against other currencies. Short-term fluctuations in the krone rate are determined by the supply of and demand for kroner in the foreign-exchange market, particularly in connection with capital flows.

Capital flows across national borders have increased considerably in volume in recent years, both to and from Denmark and internationally. Payment flows across Denmark's borders can predominantly be attributed to capital flows, while payments related to the current account of the balance of payments constitute a minor share, cf. Chart 3.7.

Capital flows, such as non-residents' purchases of Danish shares, entail capital inflows into Denmark, and the resulting transactions in the foreign-exchange market affect the krone rate. Non-residents purchas-

REGISTERED GROSS PAYMENTS TO AND FROM ABROAD

Chart 3.7



Note: Based on payment conditions in 2004. Capital payments including derivatives.
Source: Danmarks Nationalbank.

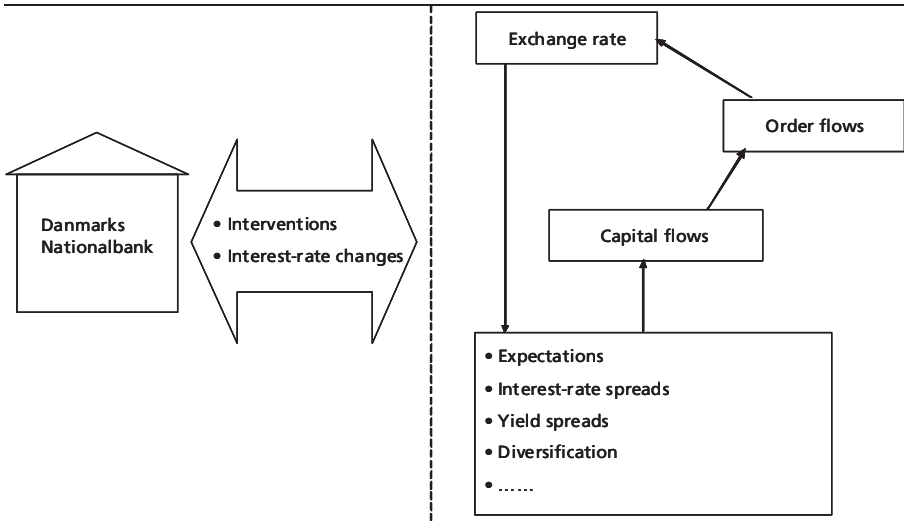
ing Danish shares need Danish kroner, which therefore generates purchase orders for Danish kroner against foreign exchange. An excess of purchase orders for Danish kroner will usually cause the krone to strengthen, because foreign-exchange dealers will raise the price for kroner as their "inventories" of kroner are depleted. Conversely, foreign-exchange dealers will reduce the price in case of an excess of sales orders.

The magnitude and direction of capital flows are affected by e.g. exchange-rate expectations and differences in interest rates and returns between countries. For example, if interest rates are raised in Denmark relative to abroad, investment in Denmark will – all other things being equal – be attractive, resulting in capital inflows into Denmark. Portfolio diversification for resident and non-resident investors also generates capital flows. Capital flows are thus influenced by many factors, including the current exchange rate. Chart 3.8 is a simple illustration of the relationship between capital flows and the exchange rate.

Capital inflows into Denmark, and thus more pronounced demand for kroner, normally cause the krone to strengthen, and vice versa for capital outflows. Temporary fluctuations in the krone rate will prompt Danmarks Nationalbank to intervene in the foreign-exchange market. The foreign-exchange dealers are normally able to absorb a share of the transactions associated with capital flows without any significant impact on the exchange rate. In the event of large capital flows and a resulting

THE FACTORS AFFECTING THE EXCHANGE RATE

Chart 3.8



effect on the krone rate, Danmarks Nationalbank will intervene in the foreign-exchange market to stabilise the krone. For example, if non-residents sell krone-denominated bonds back to Denmark, they will typically exchange their proceeds from the sale for foreign exchange at Danish banks. Unless the banks wish to change their foreign-exchange exposure, they will subsequently buy foreign exchange against kroner to restore their positions. If this causes the krone to weaken, Danmarks Nationalbank may intervene by purchasing kroner against foreign exchange from the banks. Such intervention is an order like any other order in the foreign-exchange market, in this case contributing to strengthening the exchange rate.¹ Capital flows are thus to a certain extent reflected in Danmarks Nationalbank's intervention purchases and sales of foreign exchange and ultimately in the foreign-exchange reserve.

Persistent inflows or outflows of foreign exchange and pressure on the krone will induce Danmarks Nationalbank to change its monetary-policy interest rates unilaterally, in addition to intervention.² The monetary-policy interest rates are key to money-market interest rates in Denmark, which influence capital flows. Ultimately, changes of Danmarks National-

¹ Besides the immediate effect on supply and demand in the foreign-exchange market, intervention can also have an impact through a "signal channel". The reason is that the intervention may contain indications of the future course of monetary and foreign-exchange policy that cause the market participants to revise their exchange-rate expectations. For example, if the central bank buys foreign exchange against domestic currency, this might indicate the central bank's wish to ease monetary policy in the future.

² In an empirical analysis for the period January 1996-November 2005, Beier and Storgaard (2006) find that a widening by 1 per cent p.a. of the short-term interest-rate spread between Denmark and the euro area (Germany until 1999) strengthens the krone by around 0.35 per cent on average.

bank's interest rates affects the exchange rate via market rates, which form the basis for decisions related to capital flows and thus order flows.

The economic literature often distinguishes between sterilised and non-sterilised intervention in the foreign-exchange market.¹ Non-sterilised intervention impacts on the money market, whereas sterilised intervention does not. If liquidity targeting is applied in monetary policy, as seen in conventional economic theory, the intervention is normally said to be sterilised if the transaction in itself does not influence the net liquidity position of the monetary-policy counterparties vis-à-vis the central bank. If liquidity is affected, the intervention is non-sterilised. If interest-rate targeting is applied in monetary policy, as most central banks do today, the intervention is sterilised if the transaction in itself does not impact on short-term money-market interest rates. If short-term money-market interest rates are affected, the intervention is non-sterilised.

Denmark applies interest-rate targeting in monetary policy. In calm periods – when monetary-policy interest rates remain unchanged – Danmarks Nationalbank's intervention can best be described as sterilised. In periods of unrest, when Danmarks Nationalbank typically changes its monetary-policy interest rates, the intervention can best be described as non-sterilised, cf. Abildgren (2005).

Capital flows and hedging of exchange-rate risk

Capital flows do not always impact on the exchange rate. Since a country can have both inflows and outflows of capital, the net flow is of significance to the exchange rate. In case of equal inflows and outflows, the net effect on the exchange rate will be zero, all other things being equal. Likewise, an acquisition conducted entirely in foreign exchange, even though it involves a Danish company, will have no effect on the exchange rate.

Moreover, the exchange rate will remain unaffected by capital flows if investors hedge the exchange-rate risk. An investor buying a bond abroad may hedge the exchange-rate risk by concluding a forward contract in the foreign-exchange market, cf. section 3.2. For example, a Danish investor wishing to buy a foreign bond will generally exchange Danish kroner for foreign currency in the foreign-exchange market (a spot transaction) to pay for the bond. In order to hedge the exchange-rate risk on the future foreign-exchange revenue from the bond, the investor may conclude a forward contract with a bank (sell the foreign exchange against kroner forward). The bank will then hedge its ex-

¹ Sterilised and non-sterilised intervention is described in more detail in Abildgren (2005).

DEFINITION OF CAPITAL FLOWS	Box 3.7
<p>Danmarks Nationalbank compiles capital flows to and from Denmark.¹ The capital flows can be broken down by direct investments, portfolio investments and other capital imports.</p> <ul style="list-style-type: none"> • Direct investments comprise shares and other equity instruments where an investor holds at least 10 per cent of the equity capital or voting rights in an enterprise. Direct investment also includes loans and credits between directly or indirectly affiliated enterprises (e.g. sister companies). • Portfolio investments comprise shares and other equity instruments that are not direct investment, as well as bonds. • Other capital imports comprise loans and deposits, trade credits and other accounts. 	

¹ Denmark's balance of payments and international investment position are described in more detail in Danmarks Nationalbank (2007).

change-rate risk on the forward contract (since it has bought foreign exchange against kroner forward) by selling foreign exchange against kroner spot in the market. All in all, the net demand for kroner, and thus the impact on the krone rate, will be zero.

In addition, different capital flows have different effects on the krone rate. Capital flows to and from Denmark can be broken down by direct investment, portfolio investments and other capital imports, cf. Box 3.7. Hansen and Storgaard (2005) find a significant relationship between the krone rate and capital flows from portfolio investments but no effect on the krone rate from direct investment or other capital imports.

Portfolio investments, krone rate and intervention

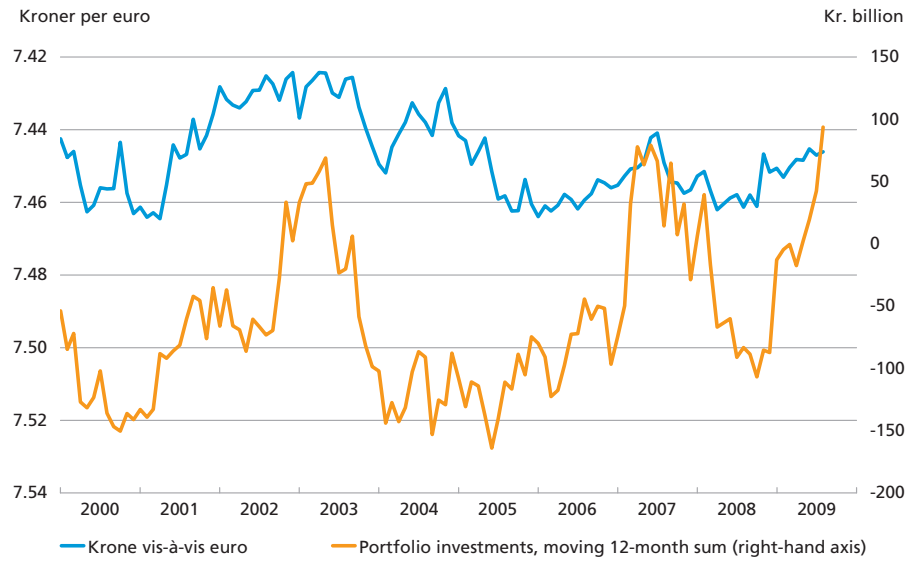
The course of the exchange rate of the krone against the euro can be partly explained by capital flows relating to cross-border portfolio investments, i.e. trading in Danish and foreign securities among Danish and foreign investors. Experience from the period 1999-2004 shows that net capital imports in the form of portfolio investments of kr. 10 billion, on average, strengthen the krone by kr. 0.12 per 100 euro, cf. Hansen and Storgaard (2005). The relation between portfolio investments and the krone rate is illustrated in Chart 3.9. However, portfolio investments are clearly not the only factor behind the development in the krone rate.

The volume of portfolio investments has been on the increase since the early 1990s, cf. Chart 3.10. Payments to and from Denmark have been fully liberalised since 1988, and recent decades have seen international diversification of investor portfolios. For example, Danish institutional investors' holdings of foreign securities are larger today than in the 1990s.

Since 2000, portfolio investments – even during periods of calm foreign-exchange markets and with a stable krone rate – have risen to

PORTFOLIO INVESTMENTS AND THE KRONE RATE

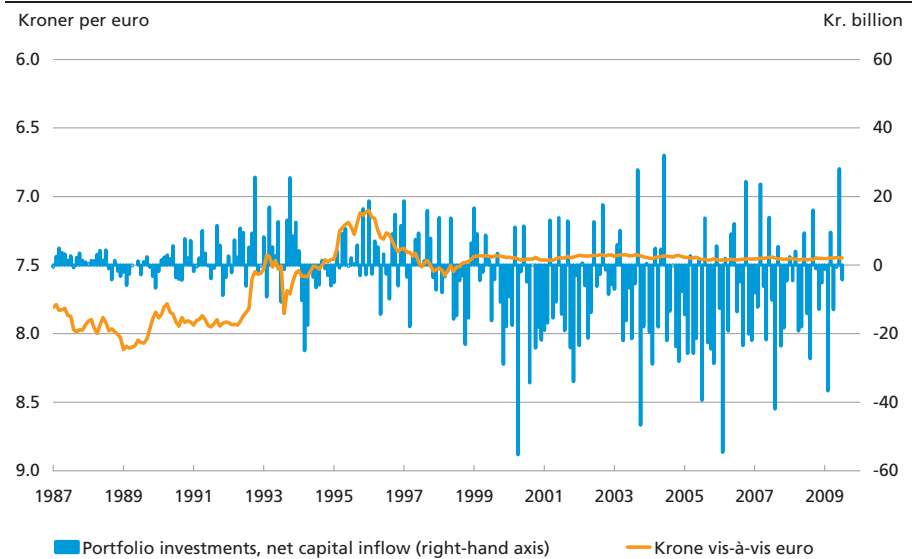
Chart 3.9



Note: The krone rate at month-end is on a reverse scale. For portfolio investments, a negative sign indicates net capital exports, while a positive sign indicates net capital imports. Portfolio investments exclude net central-government borrowing in foreign exchange.
 Source: Danmarks Nationalbank.

NET PORTFOLIO INFLOWS INTO DENMARK 1987-2009 AND THE KRONE RATE

Chart 3.10



Note: The krone rate at month-end is on a reverse scale. Portfolio investments are monthly totals. Excluding securities transactions by banks and mortgage-credit institutes in foreign exchange for their own account and central-government net borrowing in foreign exchange.
 Source: Abildgren (2008). Updated with new, revised data from the sources stated in Abildgren (2008).

volumes that were previously seen only during currency crises. Danmarks Nationalbank's interventions may therefore also be substantial even in calm periods. Since the 1980s, however, the exchange-rate effect of portfolio investments in calm periods has gradually diminished, cf. Abildgren (2008). This should probably be seen in the light of the increased credibility of Denmark's fixed-exchange-rate policy. Today, even modest interest-rate changes can be enough to stem large capital flows in calm periods.

Capital flows are sensitive to the situation in the capital markets, however. For example, foreign investors sold Danish securities in the autumn of 2008 when the international financial crisis intensified. Danish investors also sold foreign securities, but the result was a net capital outflow. This should be viewed against the backdrop of a high degree of risk aversion in the markets at that time, with investors withdrawing from minor currencies, including the Danish krone. Due to the market conditions, a given interest-rate increase had a more moderate effect than under normal circumstances.

The exchange-rate impact of Danmarks Nationalbank's interventions has also been examined in various analyses.¹ Overall, the various studies find that in periods of calm foreign-exchange markets, the interventions have an effect on the krone rate of roughly the same magnitude as that of portfolio investments as described above. For example, Andersen (2005) finds that for the period 1999-2004 intervention purchases of kroner for kr. 10 billion strengthen the krone on average by around kr. 0.14 per 100 euro.²

As regards both interventions and capital flows, the results of the various analyses are not fully comparable as they are based on different models and estimation methods. However, bearing in mind this caveat, there are indications of relative concordance, in periods of calm foreign-exchange markets, between the krone-rate effects of Danmarks Nationalbank's intervention and portfolio flows into and out of Denmark. This is consistent with theoretical results showing that central banks' sterilised interventions in the foreign-exchange market should have the same exchange-rate effect as private capital flows, provided that the intervention does not contain signals of future monetary policy, cf. e.g. Lyons (2001), Chapter 8. Most of Danmarks Nationalbank's interventions in the foreign-exchange market in the period under review are best described as sterilised, as they have taken place in periods when the

¹ Andersen (2005), Hansen and Storgaard (2005), Beier and Storgaard (2006), Abildgren (2008) and Fatum and Pedersen (2009).

² An assumption for the estimate is that the krone actually strengthens after an intervention purchase of kroner (the intervention meets the "direction criterion"). The event analysis method has been applied.

foreign-exchange market has been calm and they have not had any impact on short-term interest rates.

The effect on the krone rate of the interventions may, however, be different in situations with unrest in the financial markets, as in the autumn of 2008, cf. Box 3.2.

Acquisitions and the krone rate

Direct investment is made by companies across national borders. Acquisition of existing companies account for a considerable share of direct investment.¹ Capital flows attributable to cross-border acquisitions generally entail purchases and sales of kroner against foreign exchange in the market. A foreign company's acquisition of a Danish company will often entail increased demand for kroner up to the settlement of the acquisition, causing the krone to strengthen. Conversely, the actual settlement of the acquisition can boost the supply of kroner if the former owners do not choose to reinvest the proceeds from the sale in Danish kroner. This may cause the krone to weaken.

The acquisition process thus typically involves several currency transactions. This may be one of the reasons why the years after 1999 have seen no signs of a systematic effect on the krone rate from direct investment transactions. Another possible explanation is that mergers and acquisitions often involve exchange of equity rather than cash settlement. Moreover, the exchange rate may be affected already by rumours of acquisitions, i.e. far earlier than at the time of actual payment. Finally, the financing of the acquisition in question and the type of currency transaction may also play a role in how the exchange rate is influenced.

The effect on the krone rate of even a substantial acquisition is usually of a manageable size for the participants in the foreign-exchange market for Danish kroner.² In a few cases, however, a major acquisition, together with other factors, has influenced the krone rate to an extent that has prompted Danmarks Nationalbank to respond with intervention and interest-rate increases.³

¹ In recent years, particularly in 2005-07, several Danish companies have been acquired by foreign private equity funds. Acquisitions by private equity funds are financed mainly by domestic or foreign bank loans classified as other capital imports. Consequently, direct investment captures non-residents' acquisitions of Danish companies to a lesser extent when non-resident private equity funds make the acquisitions. Private equity funds' acquisitions of Danish companies are described in more detail in Jayaswal et al. (2006).

² The central government's major transactions normally take place outside the foreign-exchange market. A case in point is the central government's sale of shares in Tele Danmark A/S to the US company Ameritech for approximately kr. 21 billion in early 1998. The proceeds in foreign exchange were parked temporarily in Danmarks Nationalbank's foreign-exchange reserve until they were used to service the central government's foreign debt later that year.

³ This was the case e.g. at the beginning of 2006 in connection with settlement of five private equity funds' acquisition of TDC A/S, cf. Jayaswal et al. (2006). Another major acquisition took place in 2008 when Carlsberg acquired Scottish & Newcastle.

3.5 LITERATURE

Abildgren, Kim (2005), Sterilised and Non-Sterilised Intervention in the Foreign-Exchange Market, Danmarks Nationalbank, *Monetary Review*, 1st Quarter.

Abildgren, Kim (2006), The Foreign-Exchange Market for Danish Kroner, Danmarks Nationalbank, *Monetary Review*, 1st Quarter.

Abildgren, Kim (2008), Short-term impacts on exchange rates from portfolio flows to and from Denmark 1984-2004, *Danish Journal of Economics*, Vol. 146, No. 2, November.

Andersen, Allan Bødskov (2005), Exchange-Rate Impact of Danmarks Nationalbank's Interventions in the Foreign-Exchange Market, Danmarks Nationalbank, *Monetary Review*, 1st Quarter.

Beier, Niels Christian and Peter Ejler Storgaard (2006), Identifying monetary policy in a small open economy under fixed exchange rates, *Danmarks Nationalbank Working Papers*, No. 38, June.

Bie, Ulrik and Astrid Henneberg Pedersen (1999), The Role of Gold in the Monetary System, Danmarks Nationalbank, *Monetary Review*, 3rd Quarter.

BIS (2007), Triennial central bank survey of foreign exchange and derivatives market activity in April 2007, September.

Danmarks Nationalbank (2003), CLS and Payment System Stability, *Financial stability*.

Danmarks Nationalbank (2004), *Financial Management at Danmarks Nationalbank*.

Danmarks Nationalbank (2005), *Payment Systems in Denmark*.

Danmarks Nationalbank (2007), *Denmark's balance of payments and international investment position, An overall presentation of the collection and compilation of data*.

Danmarks Nationalbank (2008), *Danish Government Borrowing and Debt*.

Egstrup, Rune and Birgitte Damm Fischer (2007), Foreign-Exchange and Derivatives Markets in 2007, Danmarks Nationalbank, *Monetary Review*, 4th Quarter.

Fatum, Rasmus and Jesper Pedersen (2009), Real-time effects of central bank intervention in the euro market, *Journal of International Economics*, Vol. 78, No. 1.

Hansen, Jakob Lage and Peter Ejler Storgaard (2005), Capital Flows and the Exchange Rate of the Krone, Danmarks Nationalbank, *Monetary Review*, 2nd Quarter.

Hoffmeyer, Erik (1992), *The International Monetary System: An Essay in Interpretation*, North-Holland.

Jayaswal, Peter, Mette Kornvig og Katrine Skjærbæk (2006), Private Equity Funds, Capital Flows and the Foreign-Exchange Market, Danmarks Nationalbank, *Monetary Review*, 3rd Quarter.

Jensen, Peter Kjær (1999), The Foreign-Exchange Reserve, Danmarks Nationalbank, *Monetary Review*, 1st Quarter.

Lyons, Richard K. (2001), *The microstructure approach to exchange rates*, MIT Press.

Natorp, Lone and Tina Skotte Sørensen (2006), Settlement of Foreign-Exchange Transactions, Danmarks Nationalbank, *Monetary Review*, 4th Quarter.

Sørensen, Tina Skotte (2008), CLS – Global Highway for Settlement of Foreign-Exchange Transactions (in Danish only), *FinansInvest*, No. 7.

CHAPTER 4

The Money Market

SUMMARY

The Danish money market consists mainly of the market for interbank loan agreements and interest-rate derivatives denominated in Danish kroner with a maturity of up to one year.

The money market is closely linked to Danmarks Nationalbank's monetary-policy instruments. As a general rule, Danmarks Nationalbank provides liquidity to banks and mortgage-credit institutes – the monetary-policy counterparties – only once a week. During the week, the counterparties must therefore trade liquidity among themselves on market terms via the money market.

A well-functioning money market is essential to a clear transmission from Danmarks Nationalbank's monetary-policy interest rates to the short-term interest rates in the money market and to the rest of the financial system and the real economy. The interest rates in the money market are the basis for the banks' retail interest rates and for adjustable-rate mortgage-credit loans.

Daily turnover of loans in the Danish money market amounts to approximately kr. 80 billion, while turnover of interest-rate derivatives in Denmark amounts to approximately kr. 3 billion per day. Around half of the turnover takes place in the very short-term money market with a maturity of 1 day.

4.1 THE DANISH MONEY MARKET – DEFINITION AND PARTICIPANTS

The Danish money market consists mainly of the market for interbank loan agreements and interest-rate derivatives denominated in Danish kroner with a maturity of up to one year. Institutional investors and mortgage-credit institutes are often included as money market participants. In addition, there is the special-term market where major corporations and institutional investors in particular can borrow from and place liquidity with banks on money-market terms.

A well-functioning money market supports the efficient transfer of funds from savings holders to borrowers as well as the development of efficient financial markets. More specifically, the money market is cen-

tral to the exchange of liquidity among market participants and to the management of short-term interest-rate positions. In addition, an efficient money market contributes to a well-functioning securities market since it creates the basis for short-term financing and placement.

A well-functioning money market is essential to a clear transmission from Danmarks Nationalbank's monetary-policy interest rates to the short-term market interest rates and thus the transmission to the rest of the financial system and the real economy, cf. Chapter 5.

4.2 THE MONEY MARKET AND MONETARY-POLICY INSTRUMENTS

As a general rule, Danmarks Nationalbank provides liquidity to the monetary-policy counterparties only once a week in connection with its regular market operations on the last banking day of the week, cf. Chapter 2. During the week, the counterparties therefore have to exchange liquidity among themselves via the money market, unless Danmarks Nationalbank conducts extraordinary market operations.

It is important for a well-functioning money market that the counterparties trade liquidity among themselves on market terms. Danmarks Nationalbank is the central bank in a market economy, and during periods without financial turmoil there are normally good conditions for finding an efficient market solution for the banks' exchange of liquidity – a solution where all available information is reflected in prices (the market interest rates), where there is a narrow bid/offer spread and where the relative pricing of products in the different segments of the money market is correct. The money-market participants are thus well-informed specialists who trade frequently and who are able to conduct large transactions in standardised products.¹

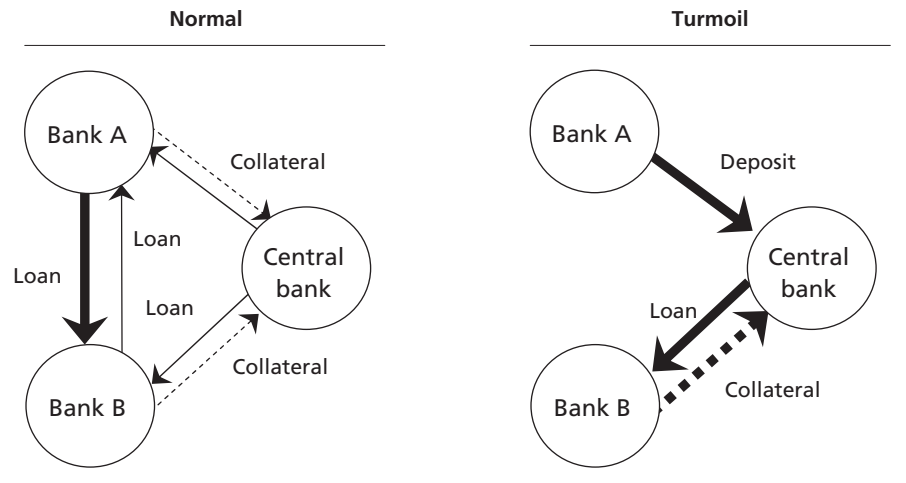
A market solution normally supports efficient liquidity management among the participants and efficient pricing with market interest rates reflecting not only the terms of the monetary-policy instruments, but also the market assessment of costs and risks.

Danmarks Nationalbank is able to address situations where the money market fails to efficiently redistribute liquidity among the market participants, as was the case in connection with the financial turmoil commencing in the summer of 2007. During the turmoil, banks became more reluctant to exchange liquidity, cf. Kjærgaard and Risbjerg (2008). Chart 4.1 illustrates this situation. Under normal circumstances, bank B, which has a shortage of liquidity, would be able to borrow large amounts in the

¹ Goodhart (1989) further analyses the conditions for well-functioning markets. Martin and McAndrews (2008) review market solutions for the distribution of liquidity.

LIQUIDITY EXCHANGE UNDER NORMAL CONDITIONS AND IN A SITUATION WITH TURMOIL

Chart 4.1



money market from bank A, which has a liquidity surplus. As a result of the financial turmoil, rather than lending to bank B, bank A builds up its own contingency liquidity, preferring to deposit it with the central bank, where the funds can be made available at short notice. On the other hand, Danmarks Nationalbank must lend a larger amount to bank B, whereby the short-term interbank market is partly replaced by balances with Danmarks Nationalbank.

Moreover, during periods of financial turmoil and uncertainty concerning credit and liquidity risks, the bid/offer spreads may increase, thereby distorting the price relations between the various products.

4.3 MONEY-MARKET INTEREST RATES AND MONETARY-POLICY INSTRUMENTS

The monetary-policy interest rates govern the interest rates in the money market. This is particularly true of interest rates on loans and placements in the very short-term money market with maturities of up to 7 days, which are close substitutes for loans from and placements in Danmarks Nationalbank. Longer-term money-market interest rates, e.g. the 3-month interest rate, which are important for the development in exchange rates, normally follow the monetary-policy interest rates. In addition to the current level of monetary-policy interest rates, expected future interest-rate changes also have a significant impact on the money-market interest rates.

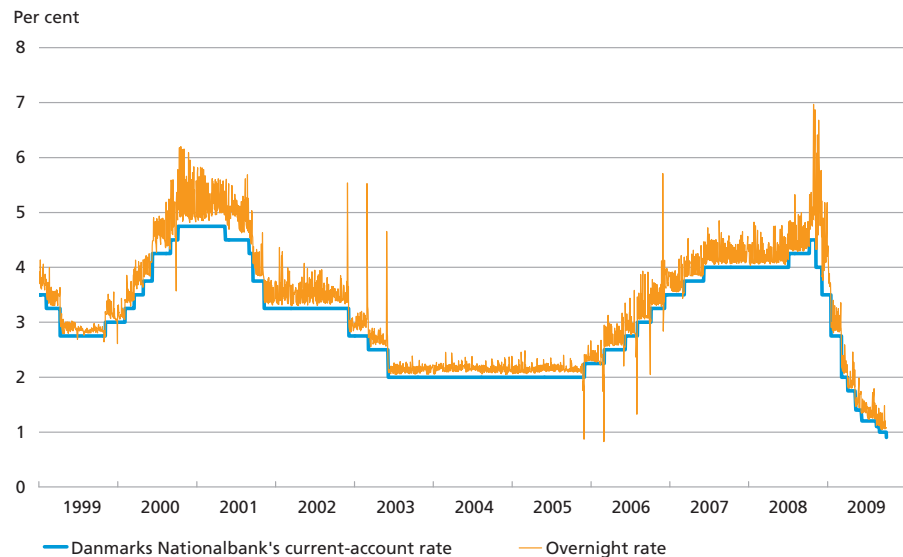
Monetary-policy instruments and the overnight rate

The monetary-policy counterparties predominantly use the overnight market in their liquidity management. The current-account interest rate normally constitutes the lower limit of the overnight interest rate in the money-market (hereinafter the overnight rate), cf. Chart 4.2. The reason is that for individual monetary-policy counterparties placements on current account with Danmarks Nationalbank (and the use of these funds) normally constitute an alternative to lending (and borrowing) via the overnight money market. Placement at the overnight rate is slightly more risky than placement at the current-account rate in Danmarks Nationalbank, but the credit risk on overnight loans in the money market is usually relatively limited.

The overnight rate varies somewhat, reflecting fluctuations in the total current-account deposits, interest-rate expectations and the design of the monetary-policy instruments. The counterparties do not have access to overnight borrowing from Danmarks Nationalbank, and as a general rule, Danmarks Nationalbank will provide liquidity only in connection with its regular weekly market operations. As a result, Danmarks Nationalbank's foreign-exchange transactions and central-government payments in kroner will initially be reflected in the current-account deposits. Fluctuations in the supply and distribution of liquidity will be reflected in the over-

DANMARKS NATIONALBANK'S CURRENT-ACCOUNT RATE AND THE OVERNIGHT RATE IN THE MONEY MARKET

Chart 4.2



Note: The overnight rate is the turnover-weighted uncollateralised Tomorrow-Next rate. 14-day maturities for monetary-policy lending and certificates of deposit led to considerable technical fluctuations in the overnight rate due to interest-rate speculation in relation to changes in monetary-policy interest rates in 2002-03 and 2005-06. Consequently, Danmarks Nationalbank introduced 7-day maturities with effect from 2 May 2007, cf. Danmarks Nationalbank (2007).

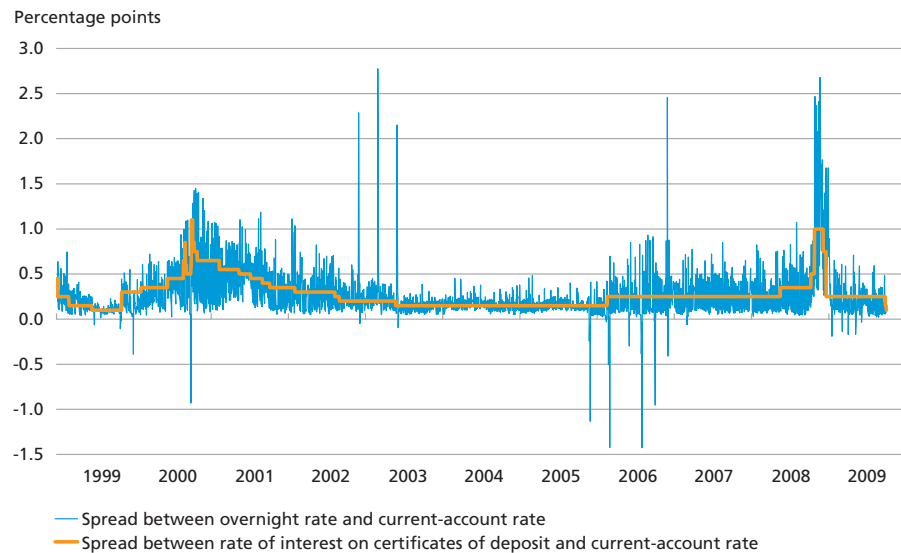
Source: Danmarks Nationalbank.

night rate. Counterparties with positive current-account deposits will seek to make a profit by lending to other counterparties who are short of liquidity. The lower the level of total current-account deposits, the higher the interest normally is on very short-term lending in the money market.

A substantial part of the fluctuation in the overnight rate is of a more technical nature and related to the design of the monetary-policy instruments, cf. Box 4.1. Due to the technical volatility, overnight rates tend to be higher when Danmarks Nationalbank is open for market operations than when it is closed. The reason is that the alternative rate of interest to placements or loans via the money market over the next 7 days is higher when Danmarks Nationalbank conducts market operations (the rate of interest on certificates of deposit and the lending rate) than when it does not (the current-account rate). When the net position is negative, Danmarks Nationalbank's lending rate is key to money-market interest rates, while the rate of interest on certificates of deposit is decisive when the net position is positive. As the lending rate is slightly higher than the rate of interest on certificates of deposit, the technical volatility will, all other things being equal, be slightly higher when the net position is negative.

An increased spread between the rate of interest on certificates of deposit (or the lending rate) and the current-account rate may lead to increased technical volatility in the overnight rate, cf. Chart 4.3. Larger

SPREADS FOR THE OVERNIGHT RATE AND DANMARKS NATIONALBANK'S INTEREST RATE ON CERTIFICATES OF DEPOSIT VIS-À-VIS THE CURRENT-ACCOUNT RATE Chart 4.3



Note: 14-day maturities for monetary-policy lending and certificates of deposit led to considerable technical fluctuations in the overnight rate due to interest-rate speculation in relation to changes in monetary-policy interest rates in 2002-03 and 2005-06. Consequently, Danmarks Nationalbank introduced 7-day maturities with effect from 2 May 2007, cf. Danmarks Nationalbank (2007). Until 8 June 2009, the lending rate was identical to the rate of interest on certificates of deposit. In the subsequent period, the net position was positive.

Kilde: Danmarks Nationalbank.

TECHNICAL VOLATILITY IN THE OVERNIGHT RATE

Box 4.1

On the first four banking days of the week, the overnight rate in the money market will tend to be close to the current-account rate. This reflects the fact that current-account deposits with Danmarks Nationalbank are the only way that the monetary-policy counterparts taken as one can earn interest on excess krone liquidity on those days. At the same time, the current-account rate represents the opportunity cost of raising liquidity using deposits in current accounts.

On the last banking day of the week, when Danmarks Nationalbank is open for sale of certificates of deposit, counterparties with excess liquidity may – in addition to making current-account deposits – purchase certificates of deposit, thereby placing liquidity with Danmarks Nationalbank for seven days at the rate of interest on certificates of deposit, which is higher than the current-account rate. If instead they choose to lend the liquidity on an overnight basis in the money market on the last banking day of the week, the assessment of the 7-day return should take into account that during the first four banking days of the following week the liquidity can only be expected to be placed in the money market at a rate of interest close to the current-account rate (or with Danmarks Nationalbank at the current-account rate). The overnight rate on the last banking day of the week (which also applies during the weekend) must therefore be relatively high to give counterparties with excess liquidity an incentive to lend in the overnight market rather than purchase certificates of deposit from Danmarks Nationalbank. Counterparties with a liquidity shortage will, on the last banking day of the week, compare Danmarks Nationalbank's lending rate with the alternative in the form of a money-market loan for the next seven days.

The counterparties' access to monetary-policy instruments on the last banking day of the week thus affects the overnight rate on the last banking day of the week. If the counterparties' net position vis-à-vis Danmarks Nationalbank is positive, the overnight rate on the last banking day of the week will, all other things being equal, be slightly lower than in periods with a negative net position. The reason is that the spread between the rate of interest on certificates of deposit and the current-account rate is smaller than the spread between Danmarks Nationalbank's lending rate and the current-account interest rate.

Chart 4.4 shows the development in the current-account and overnight rates in the second half of October 2007 when the counterparties' net position vis-à-vis Danmarks Nationalbank was positive. The Chart shows a substantial rise in the overnight rate on the last banking day of the week, i.e. on Fridays. The current-account rate was 4 per cent, and the rate of interest on certificates of deposits was 4.25 per cent.

It is now possible to calculate a theoretical value of the overnight rate on Fridays, assuming that the overnight rate on the four banking days from Monday to Thursday in the next week are expected to be the same as the current-account rate, i.e. 4 per cent. In order to comply with the requirement that the overall return on placement in the overnight market over a 7-day period must match the rate of interest on certificates of deposit, i.e. 4.25 per cent, the overnight rate on Fridays must exceed 4.25 per cent. In the example the theoretical overnight rate on Fridays (referred to as r) is given on the following basis:

$$r \text{ per cent for 3 days} + 4 \text{ per cent for 4 days} = 4.25 \text{ per cent for 7 days.}$$

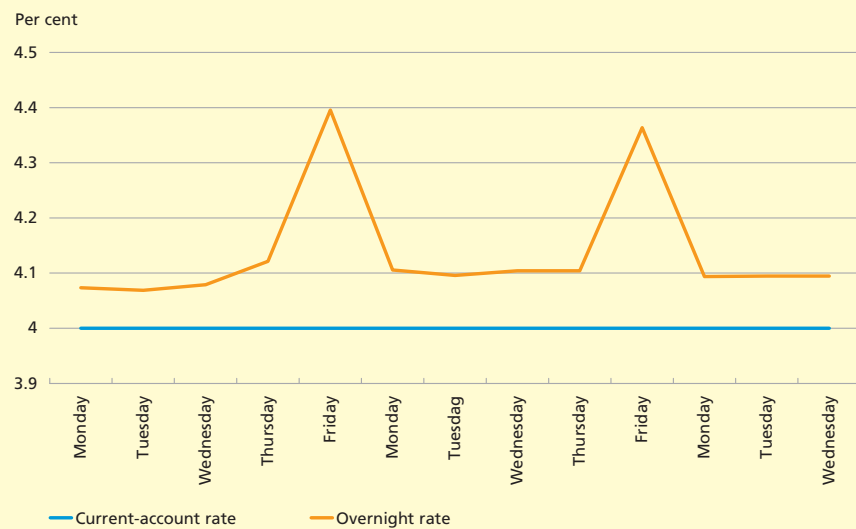
CONTINUED

Box 4.1

Note that overnight transactions concluded on Fridays run until the following Monday. Therefore, the overnight rate r on Fridays applies for three days. In the example, the overnight rate on Fridays must therefore be 4.58 per cent to match the return on the alternative placement with Danmarks Nationalbank. In the last part of October 2007 the overnight rate was lower than 4.58 per cent from Friday to Sunday and higher than 4 per cent from Monday to Thursday in the subsequent week. This should be viewed in the light of the fact that – in addition to the technical factors related to the spread between the interest rate on certificates of deposit and the current-account rate – the overnight rate in the money-market is also dependent on supply and demand for liquidity and the distribution of liquidity among the counterparties. Furthermore, the overnight rate must be expected to be slightly higher than the current-account rate due to the credit risk associated with uncollateralised lending in the money market rather than placement with Danmarks Nationalbank.

DEVELOPMENT IN THE OVERNIGHT RATE IN THE SECOND HALF OF OCTOBER 2007

Chart 4.4



Note: Data for the overnight rate relates to the turnover-weighted uncollateralised Tomorrow-Next rate shown on the settlement dates.
 Source: Danmarks Nationalbank.

differences between the current-account rate and the overnight rate have often been related to speculation in adjustment of monetary-policy interest rates.

Money-market participants understand this technical volatility element of the overnight rate, and usually such fluctuations do not affect the longer-term money-market interest rates, which are the most important rates in terms of capital flows and the krone rate, cf. Andersen (2004).

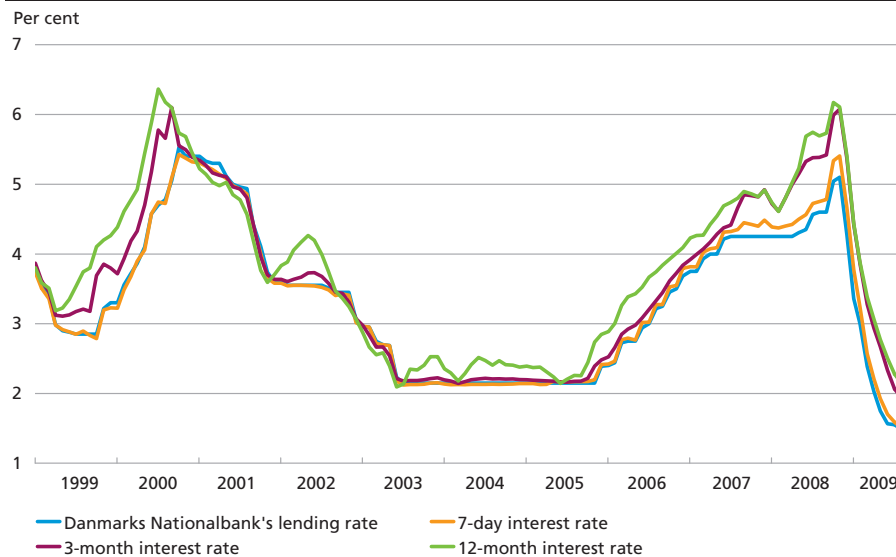
Danmarks Nationalbank's instruments do not directly set an upper limit for the overnight rate in the money market. This should be viewed against the fact that, unlike some other central banks, Danmarks Nationalbank does not offer the monetary-policy counterparties access to loans on an overnight basis, i.e. a standing lending facility, cf. Chapter 2.

Money-market interest rates and monetary-policy interest rates

Danmarks Nationalbank's market operations directly impact on the 7-day interest rate, and the short-term money-market interest rates normally follow Danmarks Nationalbank's interest rates very closely, cf. Chart 4.5. For longer maturities, the money-market interest rates may in some periods deviate from Danmarks Nationalbank's interest rates, e.g. if the market expects Danmarks Nationalbank to change its monetary-policy interest rates within the next few months. Due to Denmark's fixed-exchange-rate policy against the euro, Danmarks Nationalbank's interest rates normally follow those of the ECB, and therefore money-market interest rates in Denmark will follow developments in equivalent interest rates in the euro area very closely. Expectations of the ECB's monetary policy thus play a key role in determining the course of the longer-term Danish money-market interest rates. This is clearly apparent for the 12-month interest rate in the period from mid-2003 to end-2005,

DANMARKS NATIONALBANK'S LENDING RATE AND MONEY-MARKET INTEREST RATES

Chart 4.5



Note: Monthly averages. Money-market interest rates are Cibor rates, except for the 7-day interest rate, which is the rate of interest on uncollateralised deposits until May 2005.

Source: Danmarks Nationalbank.

when the monetary-policy interest rates remained unchanged, but shifting expectations of the ECB's monetary-policy interest rates gave rise to fluctuations in the longer-term money-market interest rates. The financial turmoil that commenced in the summer of 2007 also led to more substantial deviations than normal between uncollateralised money-market interest rates and Danmarks Nationalbank's interest rates, cf. section 4.4.

4.4 PRODUCTS

A number of different instruments are traded in the money market. These instruments can be roughly divided into two groups according to their initial impact on liquidity positions.

The first group comprises cash market products whereby the conclusion of a contract implies immediate exchange of liquidity in Danish kroner, cf. Box 4.2. Cash market products primarily comprise uncollateralised krone-denominated loans (deposits) and krone-denominated loans against collateral in bonds (repos) or foreign exchange (FX swaps), as well as krone-denominated bonds with a remaining term to maturity of up to one year, and Danmarks Nationalbank's certificates of deposit.

The cash market products are used to raise liquidity or deposit surplus funds. Moreover, certain collateralised transactions may be driven by demand for the underlying asset. For instance, a bank may be interested in providing a krone-denominated loan against collateral in a specific bond, because the bank requires the bond in order to settle a bond sale to another customer.

The second group of products comprises interest-rate derivatives, for which liquidity is exchanged only as a result of settlement of interest-rate differences at a fixed time in the future, cf. Box 4.3. The most important interest-rate derivatives in the Danish money market are Forward Rate Agreements (FRAs) and short-term interest-rate swaps. Interest-rate derivatives are used by banks, corporations and investors to hedge interest-rate risks and for position taking.

Interest rates on various money-market products

The most frequently used reference interest rates in the Danish money market are the Cibor and the T/N rates, which are both market-determined, cf. Box 4.4. They play an important role for the money market since they are used in loan agreements, including adjustable-rate mortgages, and in settlement of interest-rate derivatives. In recent years, an increasing number of banks have also opted for Cibor as the basis for their lending and deposit rates, cf. Kjærgaard and Skjærbæk (2008). Both

CASH MARKET PRODUCTS IN THE DANISH MONEY MARKET

Box 4.2

Cash market products are used to obtain or place liquidity and typically provide exchange of liquidity on the trade date or for up to two days after that.

Deposits are uncollateralised krone-denominated loans with standardised maturities from 1 day up to 12 months. Under normal circumstances the interest rate for deposits is higher than the interest rate for equivalent loans against collateral, e.g. the rate of interest on repo transactions.

Repurchase agreements (repos) are collateralised krone-denominated loans with standardised maturities from 1 day up to 6 months. The collateral pledged comprises securities, typically bonds. Repos are also known as "sell and buy-back transactions" since on the conclusion of the agreement the seller of the bonds (the liquidity recipient) enters into an obligation to buy back the securities at a later date at a price fixed when the agreement is entered into. The repo rate is reflected in the difference between the agreed purchase and sales prices (spot and forward prices).

FX swaps are collateralised krone-denominated loans with standardised maturities from 1 day up to 12 months. In this case the collateral is foreign exchange, typically dollars. FX swaps can be seen as a simultaneous spot transaction and forward contract in foreign exchange. When the spot transaction is settled, kroner are exchanged for foreign exchange, and vice versa when the forward contract is settled. The rate of interest on the krone-denominated loan is reflected in the spot and forward exchange rates applied, cf. Chapter 3 for a description of the foreign-exchange market.

Krone-denominated bonds with a remaining term to maturity of up to one year are likewise usually regarded as money-market products. This group includes short-term mortgage-credit bonds issued to finance adjustable-rate loans.

Danmarks Nationalbank's certificates of deposit are zero-coupon papers issued by Danmarks Nationalbank as part of its monetary policy. Certificates of deposit can be traded among the monetary-policy counterparties, but may not be negotiated outside the group of counterparties. Trading in certificates of deposit can be used to exchange krone-denominated liquidity without any credit risk as claims on Danmarks Nationalbank are normally regarded as risk-free.

Trading, settlement and liquidity impact

In the Danish money market the settlement date (value date) is normally two banking days after the trade date (t+2) for products with maturities longer than one day. Trading in Danmarks Nationalbank's certificates of deposit is normally settled on the same day.

Around half of the trading volume in the money market is in the overnight market, cf. section 4.6. The overnight money market includes overnight (O/N) loans, tomorrow/next (T/N) loans and spot/next (S/N) loans. O/N loans are loans commencing on the trade date and expiring on the next banking day. Thus, the settlement and liquidity effect of O/N loans both occur on the trade date. T/N loans are loans commencing on the first banking day after the trade date and expiring on the second banking day after the trade date, with settlement one banking day after the trade date. S/N loans are loans commencing on the second banking day after the trade date and expiring on the third banking day after the trade date, with settlement two days after the trade date.

The yield to maturity in per cent p.a. is calculated according to the money-market convention on the basis of the day-count convention "actual/360", with simple accrual of interest (no compound interest).

INTEREST-RATE DERIVATIVES IN THE DANISH MONEY MARKET

Box 4.3

T/N IRS (Tomorrow/Next Interest-Rate Swap) is a short-term interest-rate swap applying the T/N rate as the reference interest rate, cf. Box 4.4. When a T/N interest-rate swap is concluded, the parties in principle agree to exchange payment of interest at a fixed rate (the swap rate for the maturity in question) for payment of interest at a floating overnight rate (the T/N rate). The interest payments are calculated on the basis of a fictitious principal. The agreement can be concluded for standardised maturities between 1 and 12 months. On expiry of the swap, the parties' gains and losses are settled via the exchange of net amounts. The term "CITA swap" is often used synonymously with "T/N IRS" (CITA is an abbreviation of Copenhagen Interest T/N Average). Via interest-rate swaps, a bank with a floating-rate deposit may "swap" floating-rate payments for fixed-rate payments. Considering the deposit and the interest-rate swap as one, this is equivalent to the bank having restructured its interest-rate exposure from a floating-rate deposit to a fixed-rate deposit.

A *FRA* (Forward Rate Agreement) is an agreement to pay interest on a fictitious principal at an agreed rate for an agreed future period. At the beginning of the future period, difference settlement takes place of an amount equivalent to the difference between the agreed reference interest rate (Cibor), cf. Box 4.4, and the agreed FRA rate on the fictitious principal. No payments are exchanged on the conclusion of the actual agreement. Standardised FRAs run for three or six months. If a bank wishes to be certain of obtaining financing at the current FRA rate in a future period, it can purchase a FRA now and raise a loan at the market rate (Cibor) in the future period. If Cibor in the future period exceeds the agreed FRA rate, the bank will – via the FRA – receive an amount to compensate for the difference. On the other hand, if Cibor is lower than the FRA rate, the bank must pay.

An *interest-rate option* is an agreement granting one party the right, but not the obligation, to receive or pay a certain interest rate in a future period on an agreed principal.

reference interest rates are calculated and published daily by Danmarks Nationalbank on the basis of reports from a number of banks.

Interest rates on various money-market products normally follow each other. There are, however, some differences, reflecting differences in credit risk, liquidity risk, supply and demand conditions, etc. The rate of interest on uncollateralised products (deposits) is typically higher than the rate of interest on collateralised products (e.g. repos), primarily due to greater credit risk. In situations of financial turmoil, the spread between uncollateralised and collateralised money-market interest rates will typically widen, cf. Chart 4.6.¹

Due to the financial turmoil that commenced in the summer of 2007, the collateralised 3-month interest rates have periodically followed the monetary-policy interest rates more closely than the uncollateralised interest rates, cf. Chart 4.7.

¹ Cf. Kjærgaard and Skjærbæk (2008), which contains a breakdown of the spread between uncollateralised and collateralised money-market interest rates into credit and liquidity premiums.

REFERENCE INTEREST RATES IN THE DANISH MONEY MARKET

Box 4.4

Cibor (Copenhagen InterBank Offered Rate) is a reference interest rate for krone-denominated liquidity offered on an uncollateralised basis to a prime bank. *Cibor* is calculated on the basis of interest rates provided by individual banks, the *Cibor* reporting banks (currently 10 banks) organised under the auspices of the Danish Bankers Association. No *Cibor* reporting bank is obliged to provide liquidity at its quoted interest rate, which must nevertheless reflect market conditions as accurately as possible. For each maturity (1 and 2 weeks and 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12 months) *Cibor* is calculated based on the *Cibor* rate to two decimal places reported to Danmarks Nationalbank by all *Cibor* reporting banks at 10:30 a.m. every day. Danmarks Nationalbank then fixes *Cibor* by excluding the two highest and the two lowest interest rates and calculating a simple average of the remaining interest rates. *Cibor* rates to four decimal places are announced at 11:00 a.m. on the reporting day. The *Cibor* rate is published on Danmarks Nationalbank's website. The interest rates of the individual *Cibor* reporting banks are published on the website of the Danish Bankers Association, which also presents more detailed information on the rules for determining *Cibor*.

The *T/N* (Tomorrow/Next) rate is an overnight reference interest rate for a collateralised loan taking effect on the first banking day after the trade date and expiring on the second banking day after the trade date. The *T/N* rate is fixed on the basis of reports to Danmarks Nationalbank by the large participants in the Danish money market (currently 12 banks) organised under the auspices of the Danish Bankers Association. The participants provide information on the previous banking day's uncollateralised krone-denominated interbank lending in the *T/N* segment, and the average interest rate on the loans. On the basis of these reports Danmarks Nationalbank calculates a turnover-weighted *T/N* rate, which is published at noon on the reporting day. This rate has been selected as the overnight reference interest rate in the Danish money market because the major part of the market for uncollateralised overnight interbank lending is on a *T/N* basis.

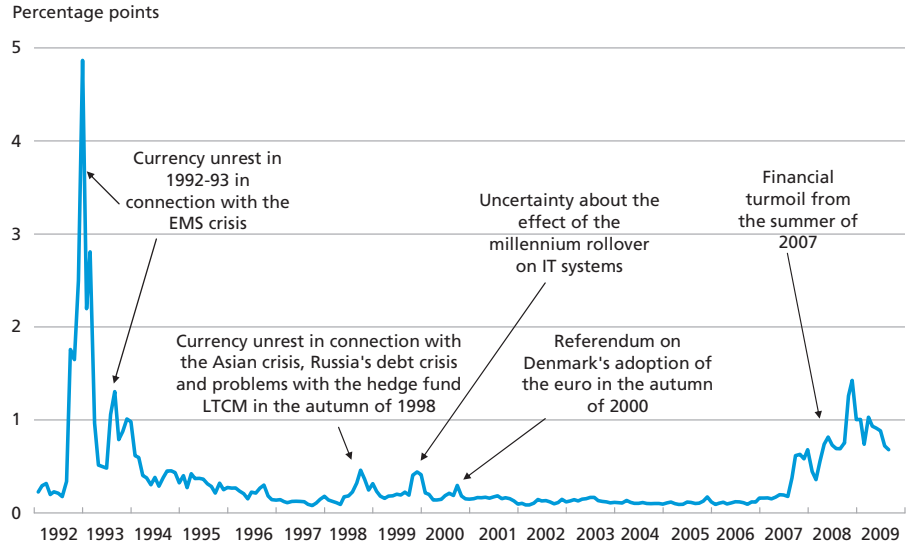
Cibor corresponds to *Euribor* (Euro InterBank Offered Rate) in the money market in the euro area. The overnight rate in the euro area is *Eonia* (Euro OverNight Index Average), which is a rate of interest on euro-denominated lending commencing on the day that the agreement is concluded, and expiring on the following banking day.

In addition to reference interest rates for the money market, reference interest rates for interest-rate swaps with maturities of between 2 and 10 years are calculated under the auspices of the Danish Bankers Association. The swap reference interest rates are calculated by Danmarks Nationalbank and can be found on Danmarks Nationalbank's website.

In addition to differences in credit risk, product-specific factors may give rise to differences in interest rates on various money-market products. For example, the rate of interest on repos and FX swaps may be driven by demand for the underlying asset pledged as collateral, i.e. bonds and currency, respectively. Strong demand for the underlying asset will, all other things being equal, press down the interest rate in relation to the rate of interest on uncollateralised loans. This also applied in connection

SPREAD BETWEEN UNCOLLATERALISED AND COLLATERALISED 3-MONTH MONEY-MARKET INTEREST RATES

Chart 4.6

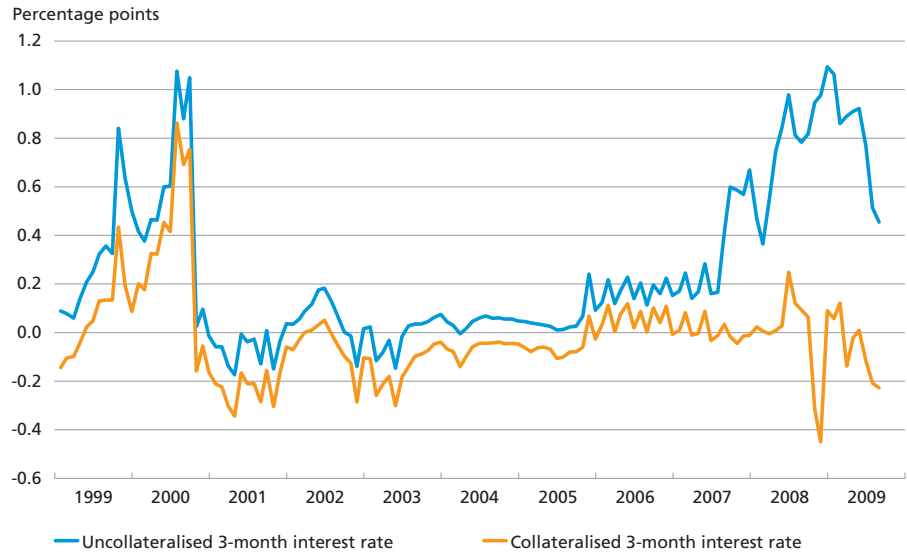


Note: Monthly averages. The collateralised money-market interest rate is for repo transactions, while the uncollateralised interest rate is Cibur.

Source: Danmarks Nationalbank.

SPREAD BETWEEN 3-MONTH MONEY-MARKET INTEREST RATES AND DANMARKS NATIONALBANK'S LENDING RATE

Chart 4.7

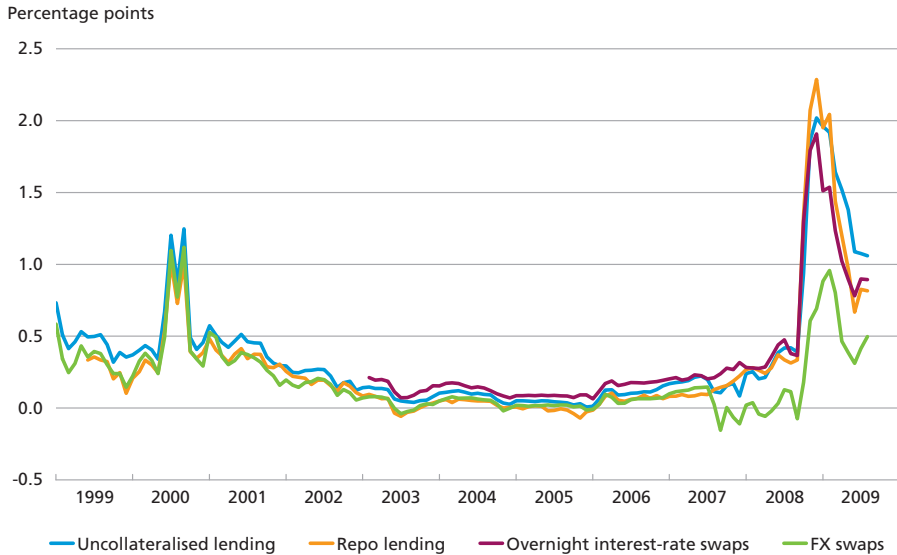


Note: Monthly averages. The collateralised interest rate is the repo rate. The uncollateralised interest rate is Cibur.

Source: Danmarks Nationalbank.

3-MONTH INTEREST-RATE SPREAD BETWEEN DENMARK AND THE EURO AREA

Chart 4.8



Note: Monthly averages. Data for interest-rate spreads for overnight interest-rate swaps from the beginning of 2003. Data for repos from mid-1999. The spread for uncollateralised lending is the Cibur-Euribor spread. The spread for FX swaps has been determined on the basis of the forward premium for forward foreign-exchange contracts between kroner and euro.

Source: Reuters EcoWin and Danmarks Nationalbank.

with the financial turmoil from the summer of 2007, when there was a shortage of euro liquidity (and dollar liquidity). This meant that interest rates on loans in kroner with euro as collateral (FX swaps) were generally lower than other money-market interest rates in Denmark, and that the interest-rate spread to the euro area for FX swaps was lower than other money-market spreads, cf. Chart 4.8.

4.5 MARKET STRUCTURE

In principle, trading in the money market is not limited to any fixed times. However, money-market transactions normally take place between 7:00 a.m. and 3:30 p.m. on banking days, when the banks can exchange liquidity via their current accounts with Danmarks Nationalbank. A transaction with liquidity effect on the same day must take place within this timeframe. When liquidity is transferred between two banks, an amount is withdrawn from the current account of the bank providing the liquidity. This amount is then placed in the current account of the bank receiving the liquidity.

Trading in the money market takes place via brokers or directly among the participants. Money-market brokers are intermediaries who do not

MARKET MAKING IN THE DANISH MONEY MARKET

Box 4.5

The market-making agreements in the Danish money market comprise around 10 banks. The banks participate in the agreements to varying extents.

Under the market-maker agreements, the participating banks are obliged to continuously state binding two-way (bid and offer) prices for fixed amounts vis-à-vis the other market makers. A maximum bid/offer spread has been fixed for each product and each maturity comprised by the agreements. Prices are stated by telephone or via money-market brokers.

The agreements operate with several "models" with varying bid/offer spreads, depending on the market conditions. Under normal circumstances the spread is typically 0.05-0.10 percentage points increasing to 0.25-0.30 percentage points in turbulent market conditions. The participants agree among themselves when to change from one model to another.

The market-maker agreements comprise repo transactions, FRAs, T/N IRSs and mortgage-credit bonds issued to finance adjustable-rate loans, whereas deposits are not included.

themselves take positions, but solely establish contact between the parties supplying and demanding money-market products. On an anonymous basis, the brokers continuously state the best bid and offer prices in the individual products for standardised maturities on the basis of rates provided by the individual banks. Prices are stated electronically and by telephone. Only a small proportion of trading in the Danish money market takes place via brokers.

Most of the trading in the money market is conducted via direct telephone contact between the counterparties, but also via electronic trade-supporting facilities. This eliminates brokerage costs and also enables trading in non-standardised maturities and contract sizes.

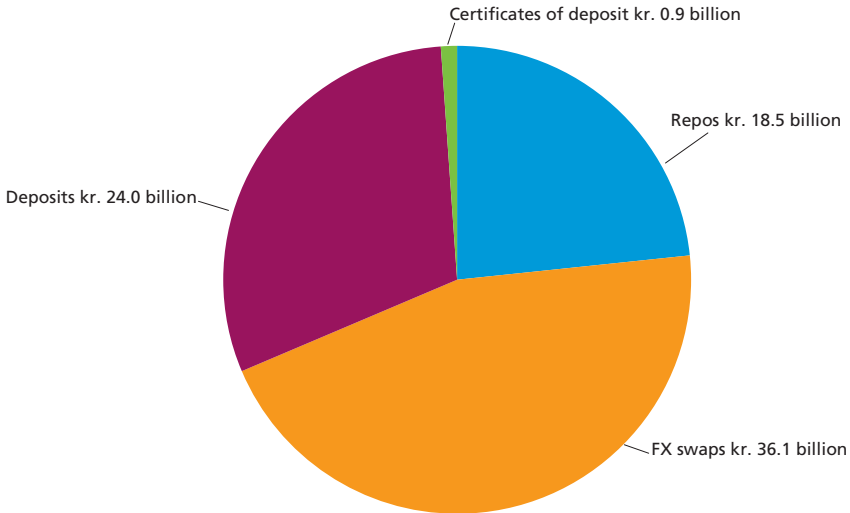
Around 10 banks have concluded mutual agreements on market making in the various segments of the money market, cf. Box 4.5. Market makers continuously set binding two-way prices vis-à-vis each other for fixed amounts in a number of specified products. Market making contributes to ensuring a certain level of liquidity in the money market.

4.6 TRADING VOLUME

The total trading volume in cash market products in the money market averages around kr. 80 billion per banking day. FX swaps account for just under half of the trading volume, while deposits and repos more or less make up the remainder. The trading volume in Danmarks Nationalbank's certificates of deposit is modest, cf. Chart 4.9.

AVERAGE DAILY TURNOVER OF CASH MARKET PRODUCTS IN THE MONEY MARKET

Chart 4.9



Note: For deposits, repos and FX swaps: average turnover of krone-denominated lending per banking day. Turnover may fluctuate considerably from day to day, and shifts between the preferred maturity segments may also affect the interpretation of the data. The reason for the latter is that, all other things being equal, turnover is higher for short-term products than for long-term products since loans with short maturities need to be refinanced more frequently than loans with longer maturities. For certificates of deposit: average turnover per banking day for interbank trading in certificates of deposit. Data for turnover in 2006 and the 1st half of 2007.

Source: Danmarks Nationalbank.

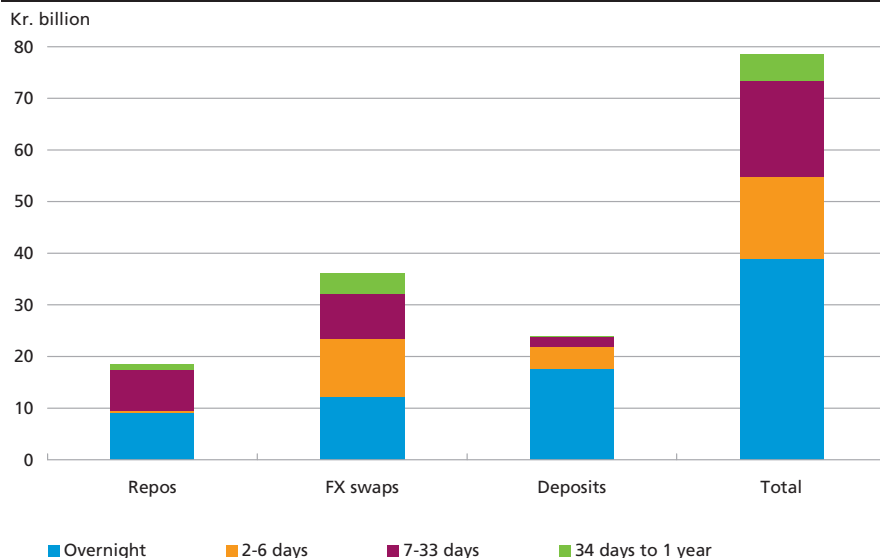
The overnight market accounts for around half of the total trading volume, cf. Chart 4.10. The monetary-policy counterparties use the overnight money market in their daily liquidity management. The major part – around two thirds – of the market for overnight interbank lending is on a T/N basis, i.e. lending of liquidity from the day after the trade date to the next day. This reflects that turnover in the overnight market originates mainly in predictable liquidity fluctuations. The O/N segment, i.e. lending of liquidity from the trade date to the next day, is used to manage unpredicted liquidity fluctuations.

Deposits account for almost half of the total trading volume in the overnight money market. Of this, one half concerns trading between Danish and foreign market participants, while the other half is traded among Danish banks and mortgage-credit institutes that are monetary-policy counterparties.

It is primarily the largest monetary-policy counterparties who are active in the uncollateralised overnight money market. Trading within this group accounts for almost half of the total volume, cf. Table 4.1. However, there is also substantial trading among the medium-sized banks.

AVERAGE DAILY TURNOVER OF CASH MARKET PRODUCTS IN THE MONEY MARKET BROKEN DOWN BY MATURITIES

Chart 4.10



Note: Average turnover of krone-denominated lending per banking day. Turnover may fluctuate considerably from day to day, and shifts between the preferred maturity segments may also affect the interpretation of the data. The reason for the latter is that, all other things being equal, turnover is higher for short-term products than for long-term products since loans with short maturities are refinanced more frequently than loans with longer maturities. Data for turnover in 2006 and the 1st half of 2007.

Source: Danmarks Nationalbank.

A large bank often acts as the main banker to smaller banks. On average, the large banks provide 2.5 loans and receive 2 deposits per banking day, and for the medium-sized banks the figure is almost one loan and almost one deposit. The largest banks conduct transactions with around 25 different counterparties, while the medium-sized banks

PERCENTAGE DISTRIBUTION OF THE VOLUME OF TRADING AMONG DANMARKS NATIONALBANK'S MONETARY-POLICY COUNTERPARTIES IN THE UNCOLLATERISED OVERNIGHT LOAN MARKET

Table 4.1

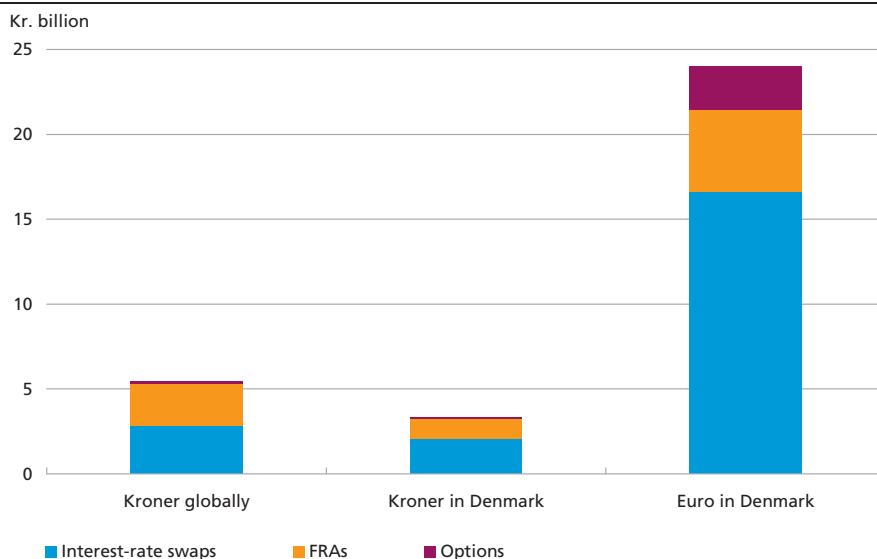
Per cent	To counterparties			
	Large	Medium-sized	Small	Total
<i>From counterparties</i>				
Large	47	16	3	65
Medium-sized	18	11	1	30
Small	3	2	0	5
Total	67	29	4	100

Note: The data comprises the volume of trading in the period from the 4th Quarter of 2003 to the 1st Quarter of 2004. The banks are grouped according to the size of the current-account limits. The determination of the current-account limits takes into account activity in the money market. The group of large counterparties is made up of the six largest banks, the group of medium-sized banks consists of 27 banks, while there are 84 banks in the group of small banks.

Source: Abildgren and Arnt (2004).

BREAKDOWN OF TURNOVER OF INTEREST-RATE DERIVATIVES

Chart 4.11



Note: Data for turnover in April 2007 stated as averages per banking day. Turnover comprises OTC trading in krone-based interest-rate derivatives (trading Over-The-Counter, i.e. trading between counterparties outside the exchanges). Turnover is not directly comparable to turnover in Charts 4.9 and 4.10 since these Charts comprise only the banks' lending of krone-denominated liquidity, while turnover in Chart 4.11 comprises both purchase and sale of contracts. In addition, Chart 4.11 includes transactions with all customers, while Charts 4.9 and 4.10 comprise lending to other banks only. Finally, the maturity is, on average, somewhat longer for interest-rate derivatives than for cash market products, implying that the significance of interest-rate derivatives is, all other things being equal, underestimated when turnover alone is considered.

Source: BIS and Danmarks Nationalbank.

have around 15 different counterparties on average, cf. Abildgren and Arnt (2004).

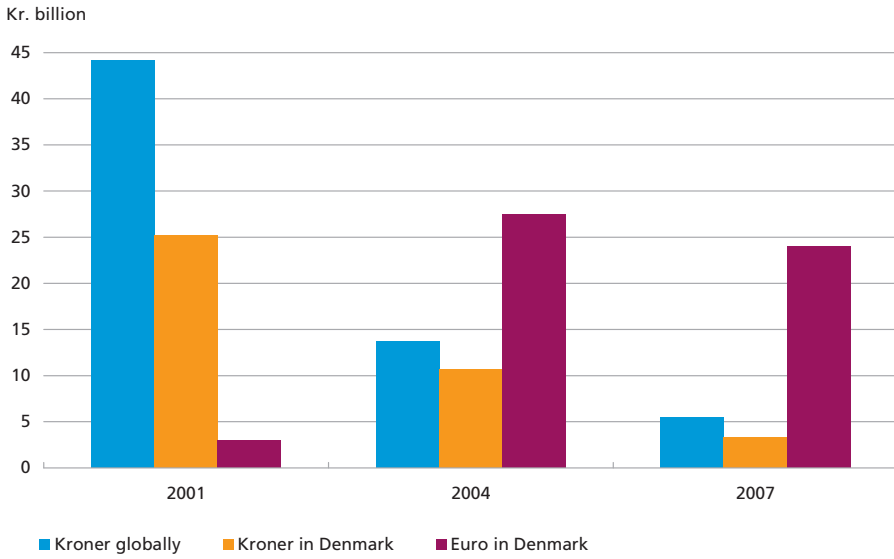
Average daily turnover in FRAs, interest-rate swaps and interest-rate options in Denmark amounts to approximately kr. 3 billion, most of which is in interest-rate swaps, cf. Chart 4.11.¹ Global turnover of krone-denominated interest-rate derivatives was around kr. 5 billion per day.

In view of the Danish fixed-exchange-rate policy, which entails very limited fluctuations in the krone against the euro, it has become customary to use the euro market to hedge interest-rate risks on short-term krone positions via euro-denominated interest-rate derivatives. As a consequence, turnover of euro-denominated interest-rate derivatives has increased in recent years, while turnover of krone-denominated interest-rate derivatives has decreased, cf. Chart 4.12. In Denmark, turnover in euro is more than five times the turnover in kroner.

¹ Data from the international survey of foreign-exchange and derivatives market activity coordinated by the Bank for International Settlements, BIS, cf. Egstrup and Fischer (2007). This survey is conducted every three years, most recently in April 2007, and comprises products traded between counterparties outside the exchanges. Short-term interest-rate derivatives are no longer traded on the Danish exchange (OMX Nasdaq, Copenhagen). Trading in Cibo futures, which was introduced in 1993, has ceased due to a lack of turnover. The use of the euro market is probably one of the reasons why Danish listed money-market products have never gained a foothold.

DAILY TURNOVER OF INTEREST-RATE DERIVATIVES IN KRONER GLOBALLY AND IN DENMARK, AND OF INTEREST-RATE DERIVATIVES IN EURO IN DENMARK

Chart 4.12



Note: Data for turnover in April 2007 stated as averages per banking day.
 Source: BIS and Danmarks Nationalbank.

4.7 LITERATURE

Abildgren, Kim and Henrik Arnt (2004), The Activity in the Danish Money Market, Danmarks Nationalbank, *Monetary Review*, 2nd Quarter.

Andersen, Allan Bødskov (2004), Volatility in the Overnight Money-Market Rate, Danmarks Nationalbank, *Monetary Review*, 4th Quarter.

BIS (2001, 2004 and 2007), *Triennial central bank survey of foreign exchange and derivatives market activity*.

Danmarks Nationalbank (2007), Change to 7-Day Maturity for Monetary-Policy Loans and Certificates of Deposit, *Monetary Review*, 1st Quarter.

Egstrup, Rune and Birgitte Damm Fischer (2007), Foreign-Exchange and Derivatives Markets in 2007, Danmarks Nationalbank, *Monetary Review*, 4th Quarter.

Goodhart, Charles (1989), *Money, inflation and uncertainty*, Macmillian Education Ltd, 2nd edition.

Kjærgaard, Morten and Katrine Skjærbæk (2008), Cibor, Danmarks Nationalbank, *Monetary Review*, 1st Quarter.

Kjærgaard, Morten and Lars Risbjerg (2008), Financial Turmoil, Liquidity and Central Banks, Danmarks Nationalbank, *Monetary Review*, 1st Quarter.

Martin, Antonie and James McAndrews (2008), Should there be interday money markets?, *Federal Reserve Bank of New York Staff Reports*, No. 337.

CHAPTER 5

Monetary Policy, Monetary Conditions and the Real Economy

SUMMARY

The financial markets and the real economy are closely interrelated. The formation of prices and interest rates in the financial markets is affected by expectations of future economic growth and inflation. Conversely, changes in interest and exchange rates influence the decisions of households and corporations, and thereby future growth and inflation. Which factors affect the formation of interest and exchange rates, and how and to what extent this influences the real economy are key issues.

Adjustments of Denmark's Nationalbank's monetary-policy interest rates and expectations of their future course are important to short-term market rates, i.e. interest rates in the money market and yields on bonds with maturities of up to 2 years. In addition, there is considerable pass-through from the monetary-policy interest rates to the banks' deposit and lending rates for households and the corporate sector. The relationship between long-term interest rates and monetary-policy interest rates is less straightforward.

Fluctuations in both interest and exchange rates affect economic activity and prices in Denmark. In a historical perspective, long-term interest rates have played a key role in corporate investment decisions and house purchases by households. However, the importance of short-term interest rates to the real economy has grown in recent years due to the increasing popularity of adjustable-rate mortgages. Moreover, the level of interest rates affects house prices and thus household wealth, which in turn affects households' consumption decisions.

The exchange rate of the krone mirrors the euro's fluctuations against other currencies, e.g. the dollar and the Swedish krona. Exchange-rate fluctuations influence foreign trade via trading relations with countries outside the euro area. The fluctuations also affect price developments in Denmark through prices for imported goods and services.

Changes in interest and exchange rates influence economic activity in the short and medium term. In the longer term, activity is determined by structural factors in the economy.

5.1 IMPORTANCE OF MONETARY CONDITIONS TO GROWTH AND INFLATION

Under Denmark's fixed-exchange-rate policy, monetary and foreign-exchange policies are aimed solely at keeping the krone stable against the euro. Other considerations than the exchange rate, e.g. cyclical developments in Denmark, are not included in monetary-policy planning. Although the outlook for growth and inflation in the Danish economy is not taken into account in monetary policy, growth and inflation are affected by Danmarks Nationalbank's interest rates. Furthermore, the exchange rate vis-à-vis other currencies than the euro may fluctuate considerably, which may have pronounced real-economic consequences in the short term due to the large export and import content in the Danish economy.

The monetary transmission to growth and inflation takes place through several channels.¹ The time horizon for these channels varies, and they may be interrelated. Chart 5.1 shows an outline of the transmission mechanism from monetary conditions to the real economy.

The *interest-rate channel* is the most direct channel. This is often the channel that first springs to mind in a macroeconomic context. Changes in Danmarks Nationalbank's interest rates or developments in the financial markets lead to changes in market rates, cf. below. Higher interest rates imply a higher yield on savings for the households at the expense of current consumption. This induces the households to postpone consumption (the substitution effect),² entailing a decrease in total consumption. In addition, the disposable income of households with debt will be lower after servicing of the debt, which also has a downward effect on consumption (the income effect).

Furthermore, higher interest rates imply higher financing costs for the corporate sector. This means that some investment projects will no longer be profitable, while others will be downscaled. As a result, the level of investment is reduced.

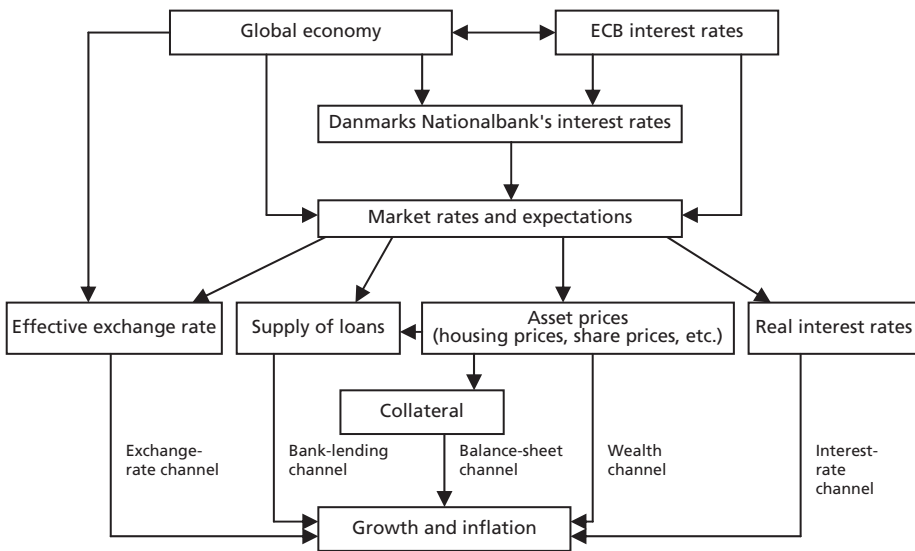
Another channel for transmission of market rates to growth and inflation is the *wealth channel*. Increased wealth enables a household to increase its consumption for the rest of its life by spending the wealth

¹ This description is based on Kuttner and Mosser (2002). See also Angeloni et al. (2003) for an in-depth discussion of the transmission mechanism in the euro area.

² The return relevant for the households' savings decisions is the real interest rate after tax, i.e. the nominal interest rate after tax adjusted for expected inflation, cf. e.g. Woodford (2003). As a consequence of price rigidities, changes in nominal interest rates entail changes in real interest rates under normal circumstances. To this should be added the taxation factors, which have had significant influence on Danish real interest rates after tax, viewed in a long-term historical perspective, cf. Pedersen (2001) and Knudsen (2002).

MONETARY TRANSMISSION TO GROWTH AND INFLATION IN
THE DANISH ECONOMY

Chart 5.1



(dissaving).¹ A change in market interest rates will have an impact on the value of a large number of assets, including stocks, bonds and owner-occupied homes, and will therefore influence household wealth and thus consumption. For example, an interest-rate increase will often lead to a drop in stock prices due to higher requirements of return on investment and expectations of lower economic growth.

Fluctuations in house prices are of great importance in this connection since housing accounts for a considerable share of household wealth. House prices will tend to fall if interest rates rise, as borrowing for home purchases becomes more expensive (or it becomes more attractive to invest in bonds or deposit the funds with the bank). Household wealth thus diminishes, and consumption weakens, all other things being equal. In addition, lower housing prices make it less attractive to build new homes.

Asset prices are also a determining factor for another monetary transmission channel to the real economy, the *balance-sheet channel*.² The borrowing terms for corporations and households depend on the size of

¹ This coupling between changes in household wealth and current consumption is based on insight from the hypotheses on permanent income, cf. Friedman (1957), and life-cycle consumption, cf. Modigliani and Brumberg (1954 and 1980). See also Deaton (1992) for the relations between these factors.

² The balance-sheet channel refers to frictions in the financial markets, including the assumption that the borrower has more insight than the lender into the profitability of the borrower's business. This correlation is thus an example of the consequences of asymmetrical information, cf. Freixas and Rochet (2008).

the collateral that the borrower is able to pledge. A change in asset prices will affect the value of the borrower's wealth and thus the collateral that can be pledged for a loan. An interest-rate increase that reduces the value of the assets will thus entail tighter credit standards in the form of higher risk premiums¹ or lower credit ceilings. Furthermore, the impact of interest-rate increases on the economy will also influence the outlook for corporate and household income and thus the credit-worthiness of corporations and households. Finally, corporate financing opportunities in the stock market will be reduced as a result of lower stock prices.

Changes in interest rates also affect bank lending via another type of friction in the financial system that is related to the banks' own balance sheets. This is called the *bank-lending channel*. In so far as an interest-rate increase leads to capital losses on securities, it may reduce a bank's capital adequacy. If the latter becomes low relative to the statutory minimum, the bank may wish to reduce its lending portfolio, e.g. by tightening the extension of credit to some customers. In addition, credit standards may be tightened in a situation where the banks themselves find it difficult to raise funds in the money and capital markets, and where the banks' losses are likely to increase. This situation may arise when a recession coincides with turmoil in the financial markets.

The total impact of changes in interest rates on bank lending via the borrowers' balance sheets (the balance-sheet channel) and the banks' own balance sheets (the bank-lending channel) is called the *credit channel*.²

The last transmission channel is the *exchange-rate channel*, which covers the effect on the Danish economy of a change in the exchange rate of the krone vis-à-vis other currencies than the euro.³ For example, if the euro – and thus the krone – weakens against the dollar, Danish goods will, all other things being equal, be cheaper in the USA since the price in dollars declines. Conversely, prices of US goods will, all other things being equal, rise when calculated in kroner. To the extent that the exchange-rate effect on prices is not offset by changes in producer prices domestically and abroad, exports will tend to rise and imports will

¹ In the economic literature, the phenomenon of higher risk premiums for companies with a low degree of collateralisation is called the financial accelerator effect, cf. Bernanke et al. (1999).

² In the literature, the bank-lending channel is also called the broad credit channel, since it may also apply to other types of credit than bank loans, cf. Bernanke and Gertler (1989). Pedersen (2003) contains a detailed discussion of the credit channel and its two sub-channels in Denmark.

³ Changes in exchange rates can be caused by e.g. expectations of shifts in interest-rate spreads between the countries in question. The monetary-policy interest rates thus impact on exchange rates, whereby the exchange-rate channel often works together with the other channels of the transmission mechanism.

tend to fall. This will boost economic activity and thus increase price pressures in the Danish economy.

5.2 FORMATION OF INTEREST RATES

Monetary-policy interest rates and short-term market rates

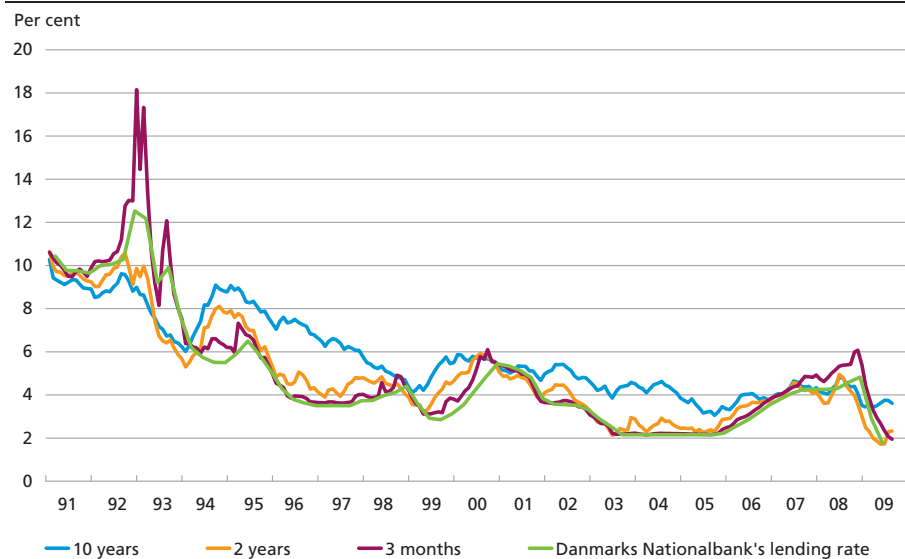
Danmarks Nationalbank's interest rates are determined in the context of the krone's exchange rate vis-à-vis the euro. The monetary-policy interest rates are of great importance to both money-market rates and bonds with maturities of up to 2 years. In situations with turmoil in the foreign-exchange market, perceived by the market as short-lived, Danmarks Nationalbank's lending rate and short-term money-market rates may, however, fluctuate substantially without any significant impact on 1-2-year interest rates. This was the case e.g. during the currency crisis in 1992-93, cf. Chart 5.2.

The banks' interest rates

The banks' average interest rates to households and the corporate sector, i.e. retail interest rates, normally follow the monetary-policy interest rates relatively closely, cf. Chart 5.3. The banks typically change their retail interest rates offered to households and small corporations within

DANISH INTEREST RATES FOR VARIOUS MATURITIES

Chart 5.2

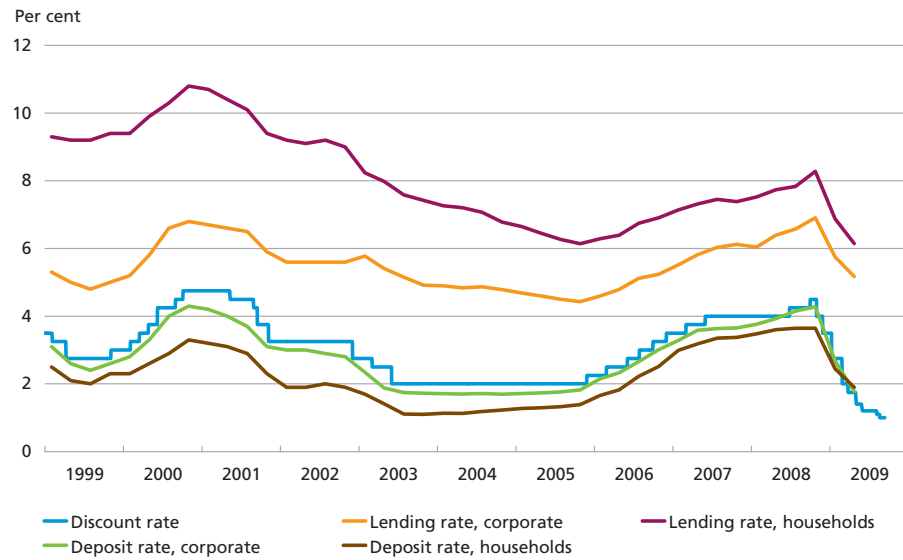


Note: Monthly averages. The 10-year and 2-year interest rates are government-bond yields, while the 3-month interest rate is an uncollateralised money-market interest rate (Cibor). For 1991-92, Danmarks Nationalbank's lending rate is the marginal lending rate.

Source: Danmarks Nationalbank.

THE DISCOUNT RATE AND THE BANKS' AVERAGE DEPOSIT AND LENDING RATES

Chart 5.3



Note: Discount rate: daily observations. The other interest rates are monthly averages.

Source: Danmarks Nationalbank.

a few weeks of Danmarks Nationalbank's adjustment of the discount rate, cf. Box 5.1. The relationship between Danmarks Nationalbank's and the banks' interest rates may be less clear in periods when the banks' earnings are under pressure.

In situations with foreign-exchange unrest that is perceived as temporary, Danmarks Nationalbank may raise the lending rate without simultaneously raising the discount rate. In such cases, the banks will often refrain from changing their retail interest rates, but change the rates of interest for agreements on money-market terms.

The close relation between the banks' retail rates on the one hand and Danmarks Nationalbank's interest rates and short-term money-market rates on the other can be attributed to two main factors. Firstly, deposits with and lending by the banks are mostly subject to variable interest rates. Secondly, Danmarks Nationalbank's monetary-policy instruments and the short-term money market are possible marginal sources of financing for the individual bank.

The banks' interest rates are also influenced by several other factors, including changes in the banks' products and shifts in competition among the banks. Furthermore, the banks' financing costs, and thus their retail rates, are influenced by conditions in the international money and capital markets. This reflects that Danish banks are increasingly operating in these markets.

PASS-THROUGH OF MONETARY-POLICY INTEREST RATES TO RETAIL INTEREST RATES

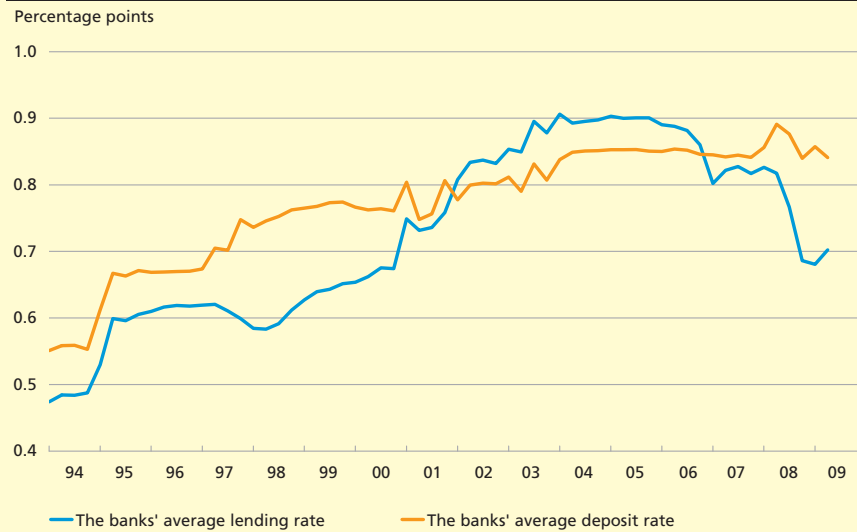
Box 5.1

When Denmark's Nationalbank adjusts its monetary-policy interest rates, the banks normally change their retail interest rates. For the period from January 2003 to December 2006, Carlsen and Fæste (2007) find that the banks changed their average interest rates in the same month that monetary-policy interest rates were adjusted, alternatively in the following month. This means that for many of their products they do not change the interest rates for every single interest-rate adjustment by Denmark's Nationalbank. The interest rates for certain products, such as mortgage loans, are tied directly to Denmark's Nationalbank's interest rate, and will therefore fluctuate in step with the latter.¹ In addition, certain bank products, typically corporate loans, are linked to money-market interest rates. Expectations of coming adjustments of the monetary-policy interest rates are normally reflected in the money-market interest rates prior to an actual adjustment, so that some banks' interest rates may change before Denmark's Nationalbank actually adjusts its interest rates.

As shown in Chart 5.4, the pass-through from monetary-policy interest rates to the banks' average lending and deposit rates has increased over time. The coefficient in a linear regression is used as the estimate of the pass-through of interest rates, measuring the average extent to which the banks change their interest rates when Denmark's Nationalbank raises its interest rates by 1 percentage point. The pass-through of interest rates rose for a long period in the early 1990s. This may reflect the increasing popularity of variable-rate loans. The greater the volume of short-term outstanding amounts and variable-rate loans, the faster the pass-through. The pass-through to the banks' lending rates decreased in 2008, which is attributable to the escalation of the financial crisis that autumn. The banks increased their interest-rate margins in the light of higher financing costs and mounting losses.

PASS-THROUGH OF INTEREST RATES OVER TIME

Chart 5.4



Note: Estimate of the response of the banks' retail interest rates to an adjustment of the discount rate (before the 3rd quarter of 1992 the lending rate). Estimated on quarterly data as a moving regression over time with periods of 32 observations. See also Carlsen and Fæste (2007) as regards methodology.

Source: Denmark's Nationalbank.

¹ The rate of interest on mortgage loans is linked mainly to Denmark's Nationalbank's rate of interest for certificates of deposit.

Long-term bond yields

There is no direct or unequivocal relation between monetary-policy interest rates and long-term interest rates. Long-term interest rates basically reflect long-term expectations of inflation and real interest rates. According to the "expectation hypothesis", long-term interest rates can also be calculated as a weighted average of current and expected short-term interest rates plus a risk premium reflecting uncertainty related to future interest-rate levels. The longer the maturity of the loan, the greater the interest-rate risk on the bond. This usually causes investors to demand a premium in the form of a higher yield. In addition, the various bond types will be subject to credit and liquidity risks that affect the level of interest rates for different types of claims.

In practice, it is complicated to map these relations, so without further assumptions it is difficult to know how adjustments of the monetary-policy interest rates are passed through to long-term interest rates. For example, the impact of monetary-policy interest rates on long-term interest rates depends on whether an adjustment of monetary-policy interest rates is expected to be permanent or temporary. If the adjustment is expected to be temporary, there is no significant impact on long-term interest rates.¹

In the longer term, the rate of inflation has been the dominant factor behind long-term interest rates in many countries. Denmark has seen a gradual fall in inflation and interest rates towards the low and stable German level as a result of the consistent fixed-exchange-rate policy vis-à-vis the D-mark since 1982, cf. Chart 5.5 and Chapter 1. If the markets have confidence in the ability of monetary policy and other economic policies to keep inflation at a stable, low level, long-term inflation expectations will be correspondingly stable, and central banks' adjustments of interest rates will not necessarily have any great impact on long-term interest rates. On the other hand, in the event of uncertainty about the scope for and commitment to an economic policy that is consistent with low inflation, bond investors will demand a premium and thus higher yields as compensation for the risk that the purchasing power of their savings will deteriorate.

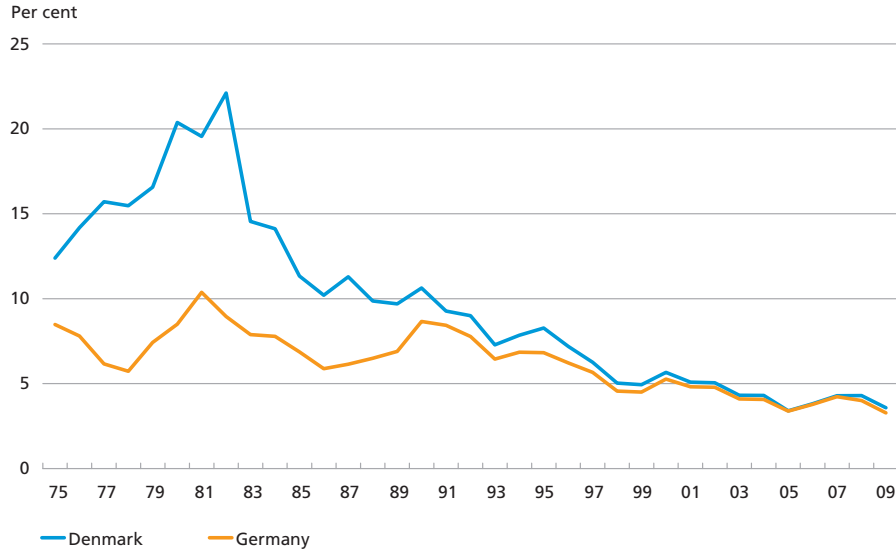
Danish long-term bond yields are strongly influenced by the development in corresponding yields in the euro area. In general, the benchmark German yield has played an increasing role as a determining factor for Danish bond yields.² In a global perspective, despite strong ex-

¹ See Ellingsen and Söderström (2001) for a theoretical analysis of how various situations can lead to different reactions in long-term interest rates when monetary-policy interest rates are adjusted, and Pedersen (1997) for an empirical application to the Danish economy.

² Berg and Sørensen (2005) compare the financial system in Denmark with those of the euro area member states and also discuss developments in the bond markets.

10-YEAR GOVERNMENT BOND YIELDS IN DENMARK AND GERMANY

Chart 5.5



Source: Danmarks Nationalbank.

change-rate fluctuations, yields in the industrialised countries tend to show the same overall patterns as a result of liberalised international capital flows and relatively synchronous inflation trends, cf. Chart 5.5. Due to the increasing importance of the global market conditions to the individual economies, the relations between national monetary-policy interest rates and long-term interest rates are less pronounced than previously.¹

5.3 THE EFFECT OF INTEREST RATES ON HOUSEHOLD DECISIONS

Household financing patterns

Households borrow mainly from banks and mortgage-credit institutes. Financing of home purchases accounts for around two thirds of total borrowing by the households, cf. Table 5.1.

Households' purchases of real property and large consumer goods are financed predominantly via mortgage-credit loans. Mortgage-credit loans have traditionally had maturities of 20 or 30 years. However, these loans are usually callable, so that they can be converted to loans at lower interest rates, should this prove favourable in connection with falling interest rates. This option is widely used.²

¹ For instance, even in the US economy, long-term yields are to a significant degree influenced by factors determined in the international markets outside the USA, cf. Bernanke (2006).

² See e.g. Knudsen (2003) for a discussion of conversions of 30-year mortgage-credit bonds in the period 1994-2003.

HOUSEHOLDS' FINANCIAL ASSETS AND LIABILITIES
(INCLUDING HOUSING WEALTH)

Table 5.1

	2003		2009, Q1	
	Kr. billion	Per cent	Kr. billion	Per cent
Assets				
Cash, bank deposits, etc.	622	14	898	15
Bonds, etc.	166	4	167	3
Stocks and mutual fund shares	400	9	424	7
Savings in life insurance, pension, etc.	1,262	29	1,797	30
Housing wealth	1,936	44	2,754	46
Assets, total	4,388	100	6,040	100
Liabilities				
Housing loans	958	64	1,585	66
of which mortgage-credit loans	862	57	1,312	55
Other loans, etc.	544	36	812	34
Liabilities, total	1,502	100	2,389	100
Net wealth	2,886	...	3,651	...

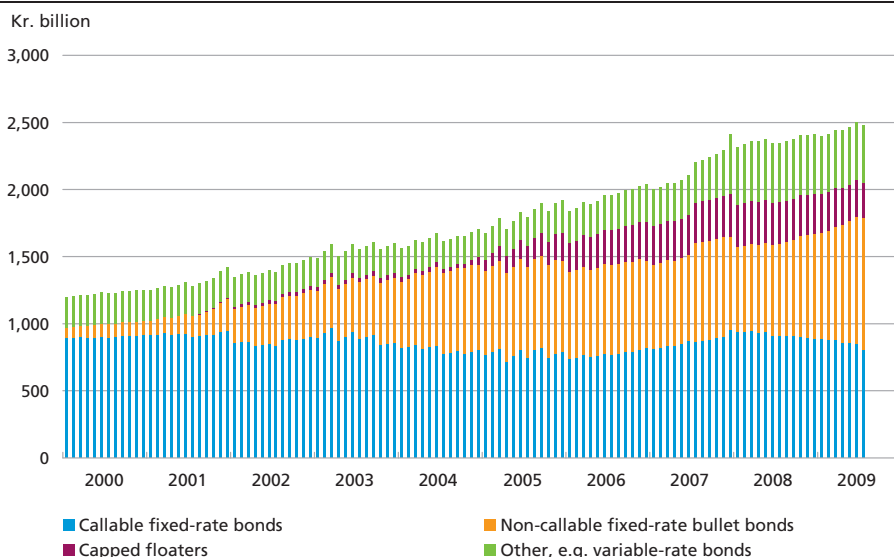
Note: End of period. The calculation of housing wealth is described in Olesen and Pedersen (2006). Housing loans, including mortgage-credit loans, have been calculated as outstanding debt. Due to rounding, the percentages do not necessarily add up to 100.

Source: Danmarks Nationalbank.

Since adjustable-rate loans were reintroduced in 1996, they have accounted for an increasing share of total lending by the mortgage-credit institutes, cf. Charts 5.6 and 5.7. The rate of interest for these loans is

OUTSTANDING BONDS IN THE DANISH MORTGAGE-CREDIT MARKET

Chart 5.6

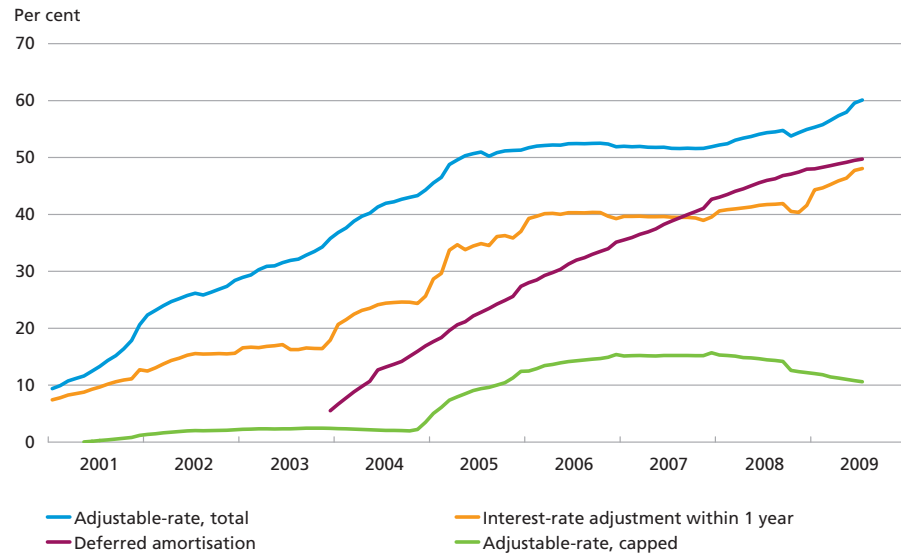


Note: Adjusted for a larger outstanding volume in December. The mortgage-credit institutes' portfolios of own outstandings are not included.

Source: Danmarks Nationalbank.

ADJUSTABLE-RATE LOANS AND DEFERRED-AMORTISATION LOANS AS PERCENTAGES OF TOTAL LENDING BY MORTGAGE-CREDIT INSTITUTES

Chart 5.7



Note: Monthly data. Mortgage-credit loans are for all sectors excluding the MFI sector. The series for deferred-amortisation loans has been subject to linear interpolation from quarterly data until end-2004. The series for capped adjustable-rate loans has been composed on the basis of lending data from the MFI statistics as from March 2008 and outstanding bonds issued to finance capped-rate loans before March 2008.

Source: Danmarks Nationalbank.

adjusted to the current market terms at agreed intervals, e.g. annually. Adjustable-rate loans have gained popularity especially in periods with a wide spread between short-term and long-term interest rates. At end-2008, they accounted for 55 per cent of total lending by mortgage-credit institutes, against 28 per cent at end-2002 and 6 per cent at end-1999, with an increasing trend during 2009. The largest share by far is loans with annual interest-rate adjustment.

Combined with borrowing from banks, this implies that up to two thirds of the interest payments made by households follow the development in short-term interest rates. It is estimated that at end-2008, 58 per cent of total borrowing by households were subject to interest-rate adjustment within 1 year. Viewed in isolation, a rise in interest rates by 1 per cent will therefore increase the households' interest expenses by approximately kr. 12.6 billion before tax, corresponding to around 1 per cent of private consumption after tax. In practice, the result of such interest-rate adjustment will vary according to the composition of the households' financial assets and liabilities.

Interest-rate adjustments will also affect the households' interest income from financial assets with variable remuneration, e.g. bank deposits and short-term mortgage-credit bonds. The households' holdings

of variable-rate bonds outside pension schemes are relatively limited, whereas their bank deposits amount to just over 70 per cent of their annual disposable income.

The housing market and private consumption

The interest-rate effect on consumption in the individual household depends not least on whether the household has net interest income or net interest expenses. Households with net interest income normally have good liquidity and good access to borrow, so they are less vulnerable to fluctuations in the disposable income than households with net interest expenses. Consumption is thus likely to react relatively more strongly to changes in net borrowers' disposable income than to changes in the disposable income of households with net interest income. This trend is undoubtedly reinforced by the asymmetrical taxation of capital income, whereby net interest income is generally subject to higher tax rates than net interest expenses.

Since the household sector overall is a net borrower, net interest expenses will generally rise for the sector as a whole when interest rates increase, resulting in a negative income effect on private consumption. At the same time, higher interest rates will boost the savings incentive and the incentive to postpone consumption. The impact via the *interest-rate channel* is thus a clear tendency towards lower consumption.

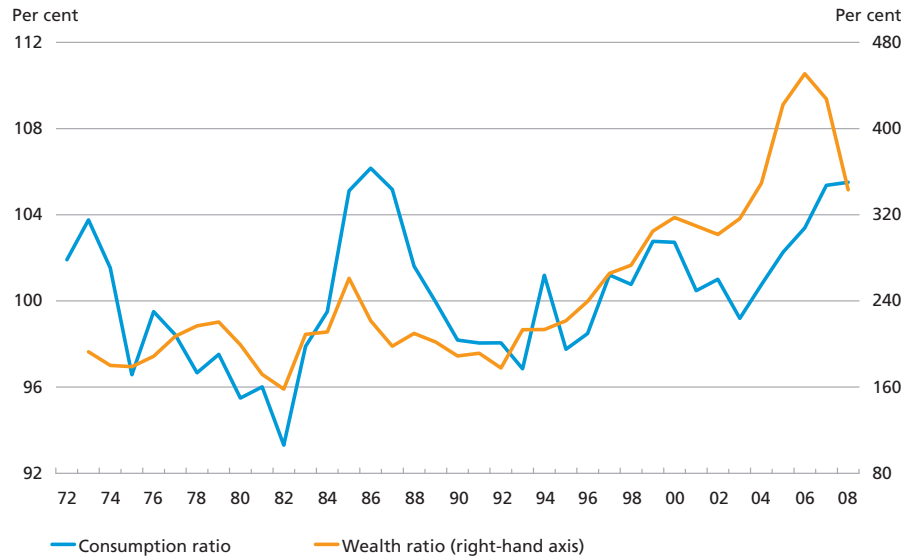
However, empirical studies indicate that the direct interest-rate effect via the interest-rate channel can explain only a small share of the development in consumption. Changes in household wealth, on the other hand, are an important explanatory variable, in empirical terms, in private consumption via the *wealth channel*, cf. Chart 5.8.¹

For the household sector overall, housing is by far the largest wealth asset, cf. Table 5.1.² In general terms, fluctuations in housing prices and in long-term interest rates are related. If long-term interest rates are rising, it becomes more expensive to finance a home purchase, and house prices tend to fall. Chart 5.9 shows a relatively strong historical co-variation between house prices and bond yields. However, especially in recent years this co-variation has been less pronounced. A possible reason is that prices have been affected by changes in financing structures in the housing market. This applies particularly to the shift towards increased use of adjustable-rate and deferred-amortisation mortgages,

¹ The relations between household consumption and wealth are described and analysed in more detail in Olesen (2008) and Dam et al. (2004).

² It is not clear whether homes for a country's population overall represent real wealth rather than redistribution between population groups, since higher housing prices entail more consumption opportunities for existing homeowners, but also increased costs for new home purchasers or tenants in new construction, cf. Buiters (2008). However, the empirical analyses in Olesen (2008) and Dam et al. (2004) point to a clear relation between housing wealth and consumption for the households.

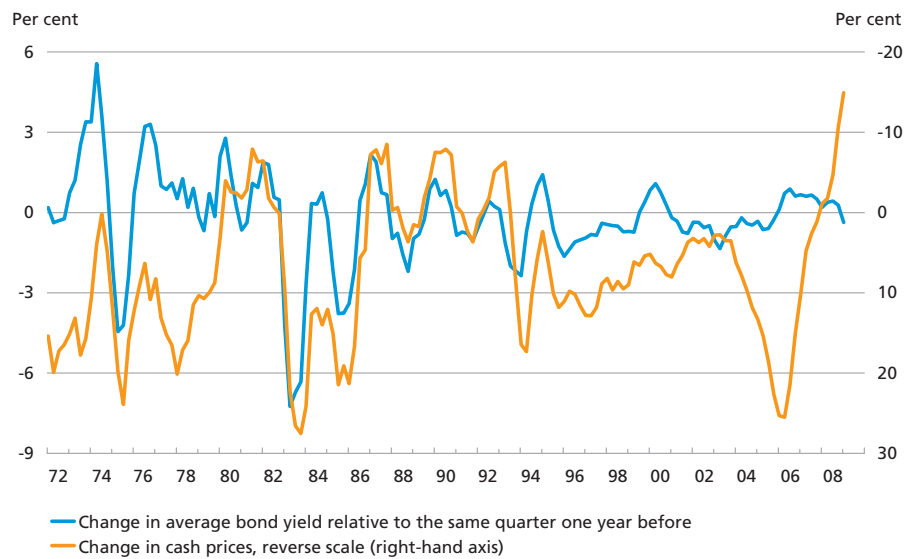
WEALTH AND CONSUMPTION AS RATIOS OF DISPOSABLE INCOME Chart 5.8



Note: The consumption and wealth ratios are private consumption and household wealth, respectively, as ratios of household disposable income. Household wealth less estimated withheld tax in pension wealth, including LD Pension and the Special Pension Fund as well as pension deposits with the banks.
 Source: Statistics Denmark and Danmarks Nationalbank. For calculation of housing wealth, see Olesen (2008).

which were introduced in 1996 and 2003, respectively. Moreover, in real terms, housing tax has gradually decreased since 2001 as part of the tax freeze.

FLUCTUATIONS IN HOUSING PRICES AND BOND YIELDS Chart 5.9



Source: Danmarks Nationalbank.

For households whose homes are financed with fixed-rate loans, an increase in long-term interest rates will reduce the market value of the debt. Since for most households the property value exceeds the housing debt, the deterioration in property value as a consequence of rising interest rates will often exceed the reduction of the debt. This erodes the net housing wealth.¹ For households with adjustable-rate mortgages, an increase in interest rates will reduce the market value of the debt by far less than would have been the case with fixed-rate mortgages. Interest-rate fluctuations will thus have a stronger impact on net housing wealth, cf. Christensen and Kjeldsen (2002). The introduction of deferred-amortisation mortgages and the banks' mortgage loans have enabled homeowners to mortgage their homes for consumption loans or to redeem loans with higher interest rates, cf. the discussion in Risbjerg (2006a).

Housing investment also depends on interest rates, which generally impact on the demand for housing, because the prices of debt servicing are closely related to interest rates. However, interest rates also impact on the relationship between prices of existing real property and of new construction, as decreasing interest rates often entail higher cash prices, cf. Chart 5.9. If cash prices for real property rise, it will thus be more attractive to build new housing than to buy an existing property, which stimulates housing investment. This correlation is illustrated in Chart 5.10.

Stocks and other liquid assets

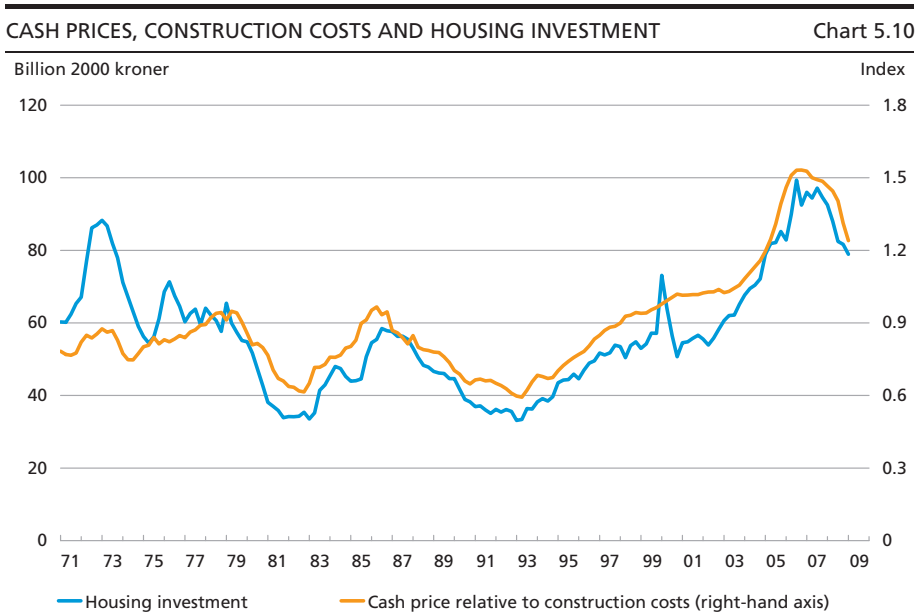
Fluctuations in interest rates also affect stock prices. Theoretically, the price of a share can be described as the discounted value of expected future dividend payments, cf. e.g. Saabye (2003). The higher the interest rate, the lower the present value of a given future dividend payment. Stock prices and long-term interest rates will thus take opposite courses, all other things being equal. However, there is no pronounced relationship in practice, which can be attributed to the impact on stock prices of other factors than interest rates.²

Surveys indicate that stock-price fluctuations in Denmark have a relatively limited impact on private consumption.³ A large proportion of Danish households have only little or no wealth invested directly in stocks.

¹ Net housing wealth is the cash value of the home less the cash value of its financing.

² For example, the modest economic growth in recent years may have tended to dampen inflationary pressures, resulting in lower interest rates, but may also have reduced the expectations of corporate earnings in future. If this effect is stronger than the discounting effect of lower interest rates, the correlation between stock prices and interest rates becomes positive. See also Hansen (2005).

³ See e.g. Ludwig and Sløk (2004) for an analysis of the significance of trends in the stock and housing markets to private consumption in a number of OECD countries. See also Dam et al. (2004) for a separate analysis of the significance of various wealth components to total consumption in Denmark.



Source: Statistics Denmark and Danmarks Nationalbank.

Nevertheless, there is broader share ownership via mutual funds, and when stock portfolios via pension schemes are included, the wealth of many households will, directly or indirectly, be influenced by stock-price fluctuations. However, experience shows that fluctuations in stock prices have only a limited impact on the households' consumption behaviour.

Finally, a significant part of the households' wealth consists of cash and bank deposits. To a large extent this can be attributed to their transaction requirements, cf. Box 5.2 and Carlsen and Riishøj (2006).

5.4 THE EFFECT OF INTEREST RATES ON CORPORATE DECISIONS

Danish corporations have a high degree of internal financing via e.g. retained earnings. The primary source of external financing for Danish corporations is debt financing, chiefly loans from banks and mortgage-credit institutes in Denmark and abroad. Direct issuance of bonds is a minor source of financing.

Table 5.2 shows that outstanding bank loans account for more than half of corporate borrowing from banks and mortgage-credit institutes. This is a considerably larger share than is the case for households. One underlying factor is that the value of the corporate sector's buildings limits borrowing from mortgage-credit institutes. Furthermore, the interest-rate spread between mortgage-credit and bank loans is narrower than for households.

MONEY STOCK AND MONEY DEMAND

Box 5.2

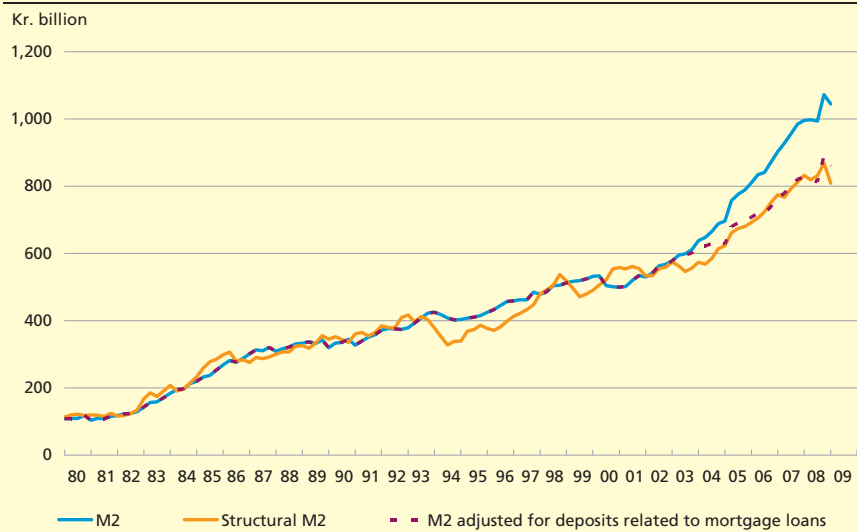
Several monetary aggregates are used in Denmark. M1 consists of the private non-bank sector's holdings of currency in circulation and overnight bank deposits. M2 is typically defined as M1 plus short-term time deposits. M3 is normally defined as M2 plus certain other deposits and holdings of short-term debt instruments. The exact definition of monetary aggregates in a Danish context appears from Danmarks Nationalbank's statistical publications.

In recent years, the development in M3 has been affected by issuance of short-term bonds to finance adjustable-rate mortgage-credit loans. Underlying bonds with an original maturity of up to 2 years are included in M3, whereas bonds with an original maturity of more than 2 years are not included. This may entail large fluctuations in relation to M2 around the turn of the year, illustrating that the information content of M3 is subject to noise and that it is often modest.

Money demand in the form of M2 is generally explained by the volume of transactions, expressed in terms of nominal domestic demand, and by the remuneration of money, calculated as the difference between the rate of interest for bank deposits and the 10-year government bond yield. The greater the transaction volume and the higher the remuneration of money compared to other placements, the greater the money demand. Chart 5.11 shows the actual money stock and the estimated structural money demand.

ACTUAL AND STRUCTURAL MONEY DEMAND

Chart 5.11



Note: Quarterly data. Estimated M2 is determined on the basis of structural demand estimated using the long-term model in Andersen (2004). The model for structural money demand is estimated on data for the period 1980-2002. M2 adjusted for deposits related to mortgage loans is M2 less growth in the banks' lending for housing purposes since mid-2003.

Source: Danmarks Nationalbank.

In boom periods, the actual money stock has exceeded the estimated demand, e.g. in the 1990s. Part of the explanation is that bank deposits typically rise when the volume of mortgage-credit conversions increases and when capital gains are realised in the wake of strong growth in housing prices. In addition, the introduction in 2003 of bank

CONTINUED

Box 5.2

mortgage loans collateralised by home equity has technically increased the actual money stock relative to estimated money demand. The reason is that when a mortgage loan is established, the bank often opens a deposit account at the same time with the nominal loan amount. The result is a corresponding immediate increase in the money stock. While the actual money stock has exceeded the estimated demand in recent years, the money stock adjusted for deposits related to bank mortgage loans has been close to the estimated demand.¹

¹ Recent years' development in the money stock is discussed in more detail in Risbjerg (2006b).

It is difficult to determine the vulnerability of corporations to fluctuations in interest rates for loans with different maturities solely on the basis of the structure of their borrowing, as a corporation may adjust its vulnerability via various financial instruments. For example, a corporation may convert a fixed-rate loan to a floating-rate loan via an interest-rate swap.

Overall, the correlation between the level of interest rates and corporate investments in plant and equipment can be expected to be negative since debt financing of the investments becomes less expensive when interest rates fall. This is confirmed in Chart 5.12. The correlation is less clear in some periods, however. The reason is that investment decisions are also influenced by other factors than interest rates, particularly sales expectations.

CORPORATE ASSETS AND LIABILITIES

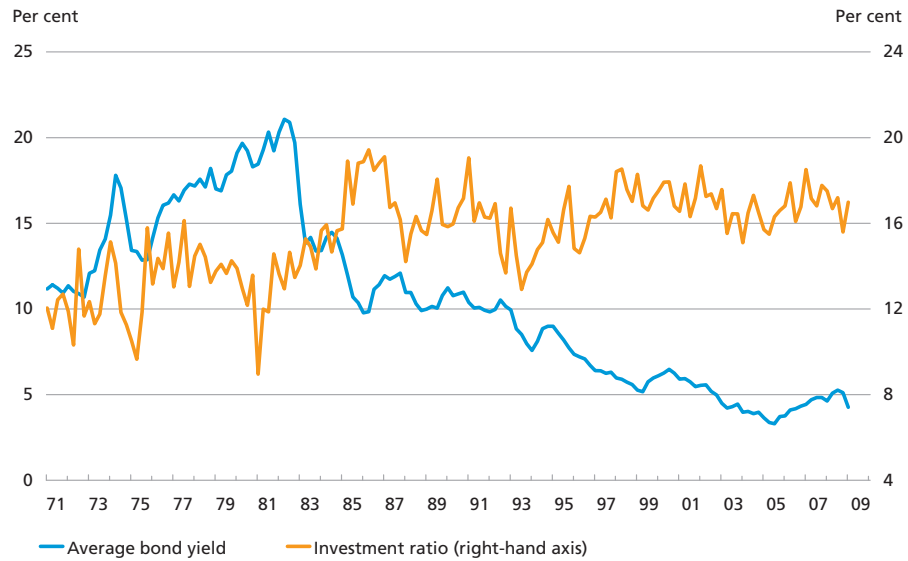
Table 5.2

	2003		2009, Q1	
	Kr. billion	Per cent	Kr. billion	Per cent
<i>Assets</i>				
Cash, bank deposits and credits, etc.....	658	46	973	49
Bonds, etc.	121	9	134	7
Shares and mutual fund shares	644	45	895	45
Assets, total	1,422	100	2,002	100
<i>Liabilities</i>				
Loans, etc.	1,157	48	1,925	58
of which bank loans	286	12	574	17
of which mortgage-credit loans	284	12	479	14
Issued bonds, etc.	109	5	109	3
Issued shares, etc.	1,136	47	1,288	39
Liabilities, total	2,401	100	3,322	100
Net financial wealth	-979	...	-1,320	...

Note: Year-end. Non-financial corporations. Due to rounding, the percentages may not add up to 100.
Source: Danmarks Nationalbank.

BOND YIELD AND INVESTMENT RATIO

Chart 5.12



Note: The investment ratio is calculated as private business investments in machinery and transport equipment as a percentage of gross value added for the private non-agricultural sector.

Source: Danmarks Nationalbank.

Corporations may use other sources of financing than bank and mortgage-credit loans, such as issuance of shares. Rising stock prices will, all other things being equal, make it more attractive for corporations to issue shares to finance investments in new real capital. In general, corporate financing structures depend on cyclical developments. In an upturn, corporations often use retained earnings as the first source of financing for investment projects, using debt financing and issuance of shares only when internal sources of financing have been exhausted, cf. Box 5.3.

In an economic downturn, the financial situation of credit institutions and borrowers deteriorates, which can lead to a general reduction of the credit institutions' supply of loans, cf. the discussion of the credit channel in section 5.1. The banks will thus typically tighten credit standards and reduce the supply of loans in an economic slowdown when the risk of default on the loans increases. This may amplify the economic slowdown.

Normally, the credit channel does not seem to play any major role in Denmark, cf. Pedersen (2003). The scope for a credit channel is limited, partly because households and corporations have relatively easy access to alternative financing from mortgage-credit institutes, where the credit channel plays a minor role, except what follows from changes in the value of the mortgaged property. The balance principle for mortgage-credit institutes means that there are no significant supply-side effects via the mortgage-credit institutes' balance sheets.

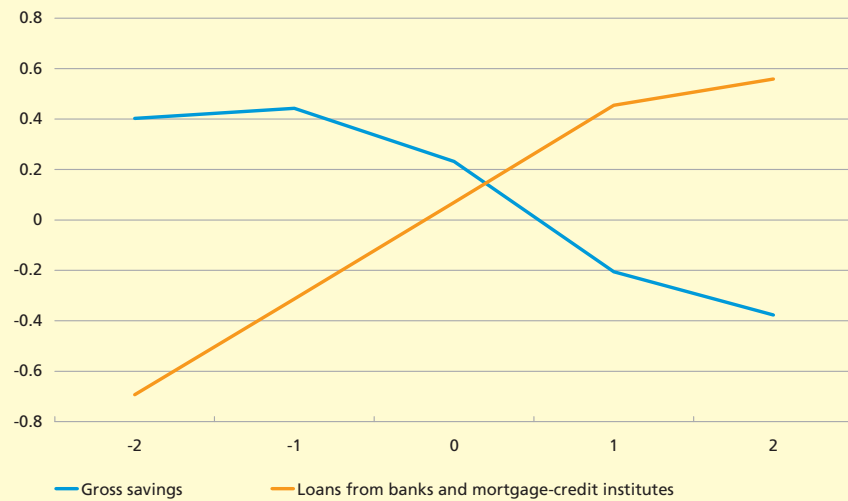
CORPORATE FINANCING AND ECONOMIC DEVELOPMENT

Box 5.3

Lending by banks and mortgage-credit institutes to the corporate sector typically begins to rise at a later stage of an upswing than lending to households, cf. Risbjerg (2006a). The reason is that investment often responds later than consumption. Moreover, corporations tend to use internal sources of financing, e.g. retained earnings, at the beginning of an upswing. The corporations do not resort to the more expensive debt financing until later in the upswing, as investment requirements increase and spare capacity is utilised. Likewise, the credit institutions may put any major expansion of credit to the corporate sector on hold until the upturn is reflected, with a certain lag, in stronger financial statements. Lending by mortgage-credit institutes normally lags slightly behind lending by banks. Possible explanations are the particularly long planning-related delay in corporate building and construction investments, and the more favourable access to mortgage credit as the valuation of the collateral pledged for the mortgage credit rises during an upswing.¹

CORRELATION BETWEEN GDP AND GROSS SAVINGS AND LOANS IN PRECEDING, CURRENT AND SUBSEQUENT YEARS

Chart 5.13



Note: Non-financial corporations. Gross savings and loans are deflated using the GDP deflator. The correlation is calculated for the cyclical component (using an HP filter with a dampening factor of 100) in annual time series for the period 1981-2008.

Source: Statistics Denmark and Danmarks Nationalbank.

The cyclical development in internal financing and debt financing in the corporate sector can be illustrated by calculating the correlation between the cyclical component in real GDP on the one hand and on the other the cyclical components of corporate gross savings and loans from banks and mortgage-credit institutes, cf. Chart 5.13. The Chart shows that the cyclical component of gross savings peaks earlier than the cyclical component of GDP, while corporate borrowing peaks later. This confirms that corporations use internal sources of financing (gross savings) early in a boom and debt financing at a later stage.

¹ See Petersen and Risbjerg (2009) for an analysis of corporate financing over business cycles.

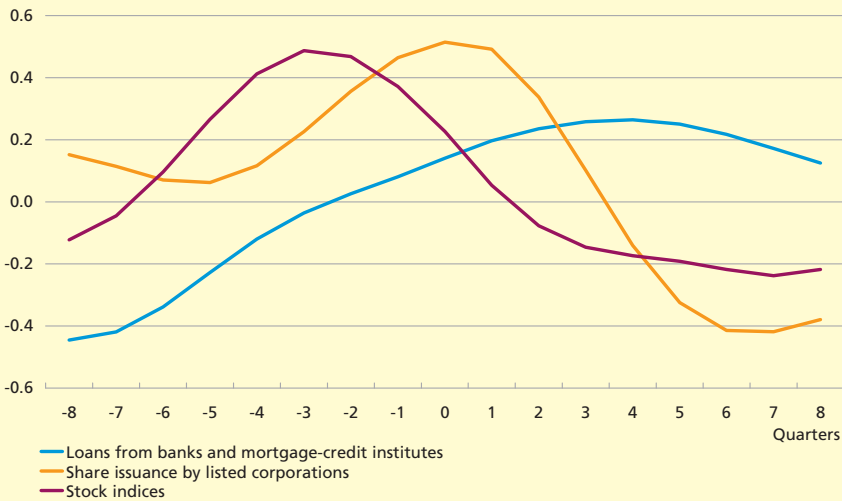
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Box 5.3

In a boom, listed corporations tend to issue shares, which are normally a more expensive source of financing, before using debt financing. The reason is that the costs of share financing fall when stock prices rise, which typically occurs already at an early stage of an upswing, cf. Chart 5.14. Issuance of shares by listed corporations thus has an element of timing.

CORRELATION BETWEEN GDP AND LENDING, SHARE ISSUANCE AND STOCK PRICES IN PRECEDING, CURRENT AND SUBSEQUENT QUARTERS

Chart 5.14



Note: Lending is lending to non-financial corporations. Issues for existing listed non-financial corporations, i.e. excluding initial public offerings. Gross issuance, i.e. excluding write-down of share capital and corporations' buy-back of own shares. The calculation is made for the cyclical component of the time series. The cyclical component is calculated using Baxter-King band-pass filtered quarterly data for the period 1983-2007 as fluctuations of a duration of 1.5-8 years.

Source: Account Data, OMX Nordic Exchange Copenhagen, Statistics Denmark and Danmarks Nationalbank.

A special situation – a *credit crunch* – may arise when the banks' lending is considerably restricted as a result of substantial deterioration of the balance sheets of borrowers and banks alike. If a credit crunch exists, it is difficult to find financing even for creditworthy projects. The risk of a credit crunch is greatest when a recession coincides with a crisis in the financial sector.

5.5 THE EFFECTIVE KRONE RATE AND ITS IMPACT ON FOREIGN TRADE

Since the fixed-exchange-rate policy ensures that fluctuations in the krone rate against the euro are kept at a very modest level, the krone will match the euro's fluctuations vis-à-vis other currencies. The krone may weaken against one currency, while strengthening against another. To assess when the krone overall weakens or strengthens the *effective*

krone rate is calculated as a weighted average of the bilateral exchange rates vis-à-vis Denmark's major trading partners. An increase in the effective krone rate index indicates a strengthening of the krone vis-à-vis the weighted average of the currencies in the index.

The weights of the krone-rate index reflect the competitive environment for trade in industrial goods.¹ The euro area is by far Denmark's most important trading partner, accounting for just over 50 per cent of the weight basis. Fluctuations in the effective krone rate are attributable to the krone's fluctuations against the largest trading partners outside the euro area.

The nominal effective krone rate has been relatively stable since 1980, even though the exchange-rate policy does not aim at managing the index taken as one. Patterns vis-à-vis individual currencies, on the other hand, have varied considerably, with the weakening of the Swedish krona and the strengthening of the yen as the most extreme examples among the currencies included in Chart 5.15.

All other things being equal, a decline in the effective krone rate will make Danish goods cheaper abroad, as the price in foreign currency becomes lower. Conversely, the price in Danish kroner of goods manufactured abroad will increase in Denmark. In so far as the direct effect on prices is not offset by changes in producer prices in Denmark and abroad, the volume of exports will tend to increase, while the volume of imports will decrease. This will stimulate economic activity in Denmark and will induce upward pressure on domestic prices, both directly via higher import prices, and indirectly via expanded activity. Since exports and imports of goods and services account for a large and growing share of the gross domestic product, GDP,² fluctuations in the effective krone rate may be of substantial significance to the outlook for growth and inflation, cf. Pedersen (2007).

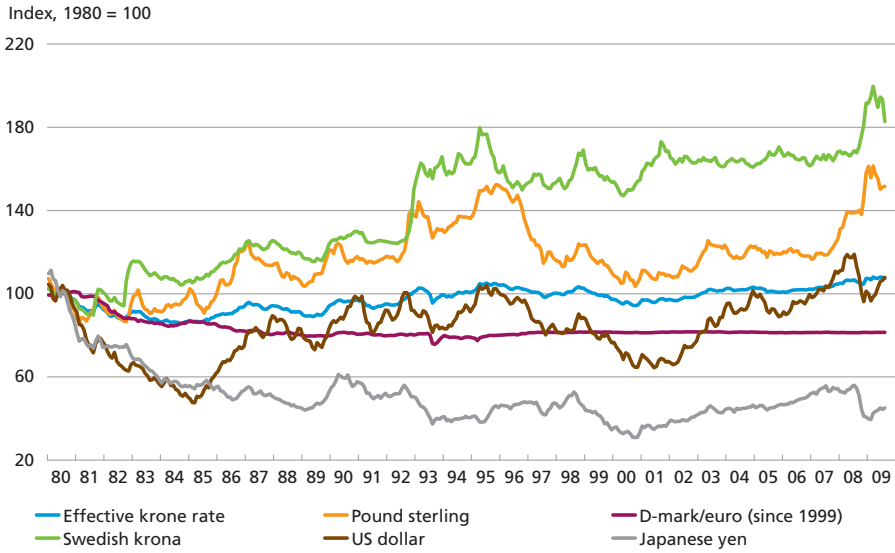
In an empirical analysis of the pass-through of the effective krone rate to the real economy, it is important to adjust the nominal exchange-rate fluctuations for country-specific price developments. For example, if the exchange rate has depreciated vis-à-vis abroad, but inflation and wage inflation remain correspondingly higher in Denmark, competitiveness will not improve. The effective krone rate adjusted for relative price developments is called the *real effective krone rate*. Chart 5.16 shows the development in the real and nominal effective krone rates. Since the mid-1980s, the real effective krone rate has shown an increasing trend,

¹ The weights are calculated on the basis of trade in industrial goods in 2002. See also Pedersen (2004) and the references therein for the weights of the individual countries in the effective krone-rate index and a detailed description of its calculation.

² In 2008, exports and imports of goods and services accounted for 55 and 53 per cent of GDP, respectively, compared with 37 and 33 per cent, respectively, in 1990.

NOMINAL EFFECTIVE KRONE RATE AND BILATERAL KRONE RATES

Chart 5.15

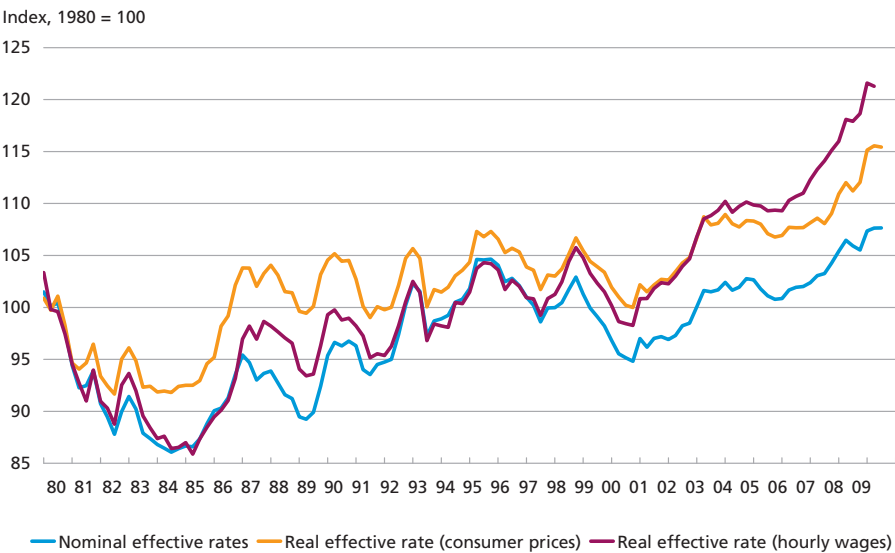


Note: For the bilateral exchange rates an increase in an index reflects the krone's strengthening against the currency in question. For the effective krone rate an increase in the index reflects the krone's strengthening vis-à-vis the weighted average of the currencies in the index.

Source: Danmarks Nationalbank.

DEVELOPMENTS IN THE NOMINAL EFFECTIVE KRONE RATE AND TWO MEASURES OF THE REAL EFFECTIVE KRONE RATE

Chart 5.16



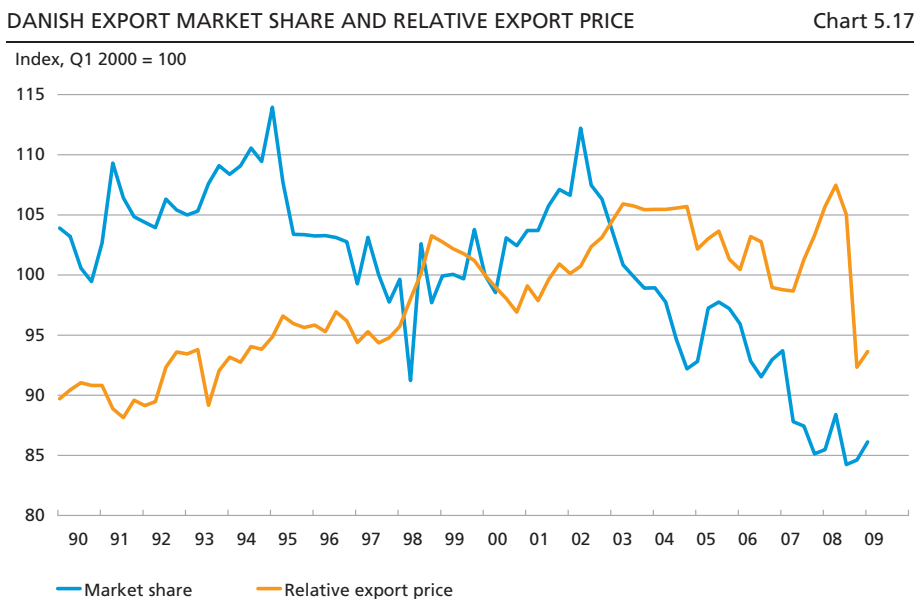
Note: An increase in the index reflects the krone's strengthening vis-à-vis the weighted average of the currencies in the index. The real effective exchange rates have been adjusted for the relative developments in consumer prices and hourly wages, respectively.

Source: Danmarks Nationalbank.

which can be explained by several economic fundamentals. In particular, there are indications that a persistent increase in the terms of trade, i.e. export prices relative to import prices, can explain this rising trend, cf. Sørensen (2008). However, many fluctuations in the real effective krone rate coincide with fluctuations in the nominal effective krone rate.

It is difficult to establish a close empirical relation between the course of the effective krone rate and that of imports and exports. The principal reason is that the volume of foreign trade reacts sluggishly to relative price changes between goods manufactured in Denmark and abroad, while cyclical developments in the export markets play a key role. A further complication is that exporters and importers also change their prices when the exchange rate changes, which offsets the direct price effect of the exchange-rate change. For example, experience shows that Danish exporters typically, with a certain lag, raise their prices (in Danish kroner) when the krone weakens. Likewise, foreign exporters often reduce the price in national currency when the krone weakens. In addition, exporters and importers may conclude forward foreign-exchange contracts in order to cushion some of the effects of future exchange-rate fluctuations.

Chart 5.17 shows the development in the market share for Danish industrial exports together with relative Danish export prices. If Danish

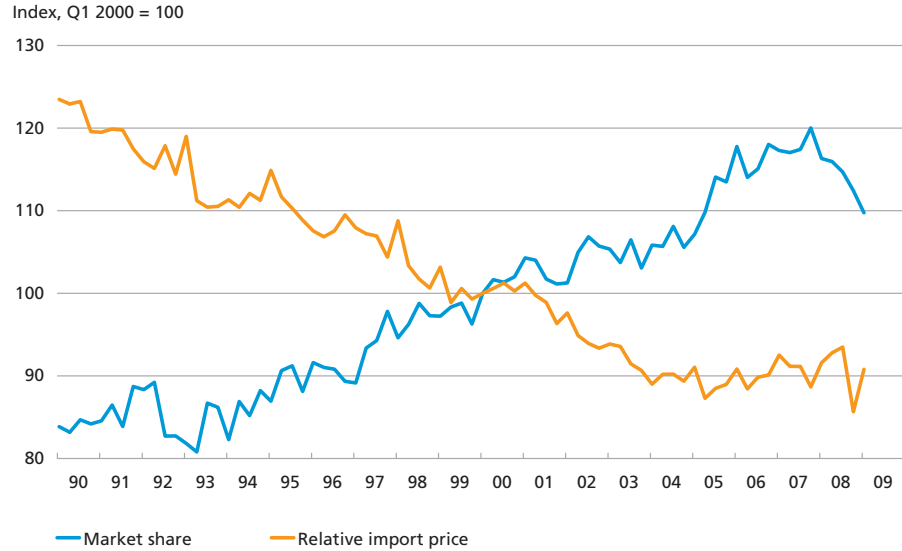


Note: The market share is Denmark's industrial exports as a ratio of the size of Denmark's export markets. The size of Denmark's export markets is calculated as a weighted average of the imports of Denmark's trading partners. The relative export price is the price for Danish exports in relation to the competing price in the individual markets, weighted by market size in Danish exports.

Source: Statistics Denmark and Danmarks Nationalbank.

IMPORT MARKET SHARE IN DENMARK AND RELATIVE IMPORT PRICE

Chart 5.18



Note: The relative import price is the price for imports to Denmark in relation to the deflator for value added in the private, non-agricultural sector in Denmark. The market share reflects imports to Denmark of goods, excluding energy, ships and aircraft in relation to domestic demand for these goods.

Source: Danmarks Nationalbank and Statistics Denmark.

export prices rise, making Danish goods more expensive abroad, the market share is assumed to decline. In some periods, this relation is less obvious, as other factors carry more weight than the development in relative export prices, cf. Nielsen (1999), although the relation is strong in the longer term. Recent years' underlying trend towards loss of market shares should thus be viewed in the light of gradually intensifying competition from emerging market economies in step with globalisation, which has also increased the size of the market.

Chart 5.18 shows the import market share in Denmark and the relative import price. As before, the relation between import price and market share in Denmark can be expected to be negative, which is indeed the case. In general, the pass-through of price adjustments to exports is stronger than that to imports. The background is that Denmark is a small country with no own production of a large number of the goods needed, so Denmark is unable to substitute imported goods for Danish-made varieties when import prices rise.

5.6 EFFECTS OF INTEREST AND EXCHANGE-RATE CHANGES ON GDP AND CONSUMER PRICES

The combined impact of interest and exchange rates on economic developments is complex and far from uniquely determined by economic

theory. An overall assessment of their impact on household and corporate decisions – and thus on activity and price developments – requires economically consistent and empirically relevant modelling of the interrelations between the various transmission channels. For example, it should be taken into account that the real-economic effects often occur with relatively large lags, which can change over time. The following presents calculations, using Danmarks Nationalbank's macroeconomic model, MONA,¹ of how fluctuations in interest and exchange rates impact on economic activity and inflation.

An experiment based on changes in Danish interest rates or the effective krone rate only, independently of the development in the euro area, is useful in order to understand and quantify the transmission mechanism in Denmark. However, this scenario may appear somewhat theoretical and constructed, given Denmark's fixed-exchange-rate policy. Unilateral adjustment of Danmarks Nationalbank's interest rates relative to those of the European Central Bank, ECB, will only occur in short periods of currency unrest. These calculations are therefore supplemented with a scenario of rising Danish interest rates in response to an increase in monetary-policy interest rates in the euro area, with simultaneous appreciation of the krone against other currencies.

Effects of isolated changes in Danish interest and exchange rates

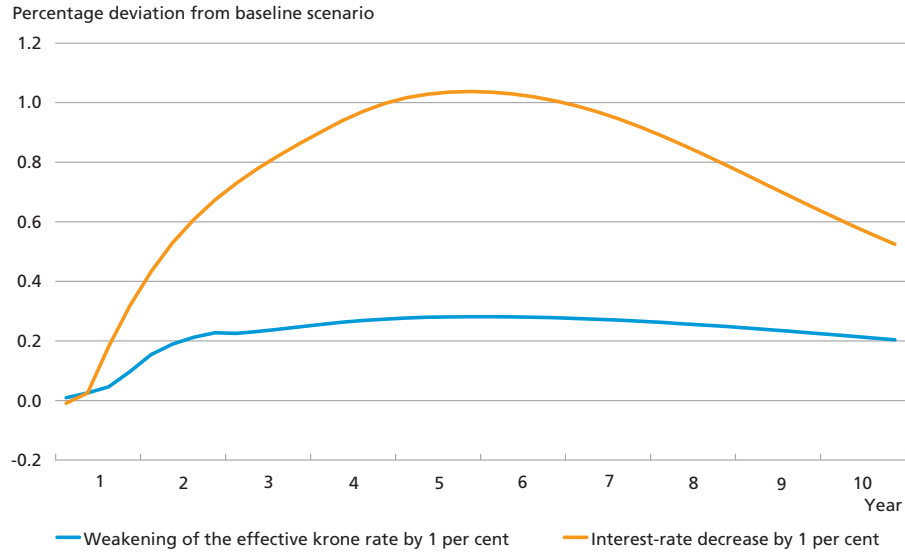
The interest-rate experiment specifically assumes a permanent decrease in Danish interest rates (before tax) by 1 percentage point for all maturities. In the calculation of the effect of a change in exchange rates, a permanent decrease in the krone rate by 1 per cent vis-à-vis all other currencies is assumed, corresponding to a drop in the effective krone rate by 1 per cent. The calculations are made in relation to a 10-year baseline scenario.

A decline in interest rates and a weakening of the effective krone rate both have a positive impact on economic activity. For both experiments, Chart 5.19 shows the impact on GDP over time compared with a given baseline scenario. An expansionary GDP effect is seen on a decrease in interest rates by 1 per cent. The effect peaks after 4-6 years, when GDP is approximately 1 per cent higher than in the baseline scenario. After this time, the effect gradually subsides. The overall effect on GDP is more subdued in the experiment with a weakening of the krone. The overall effect on economic activity of the development in interest and exchange rates can be expressed by a financial conditions index, cf. Box 5.4.

¹ Danmarks Nationalbank's macroeconomic model, MONA, is described in Danmarks Nationalbank (2003).

EFFECT ON GDP IN VOLUMES

Chart 5.19

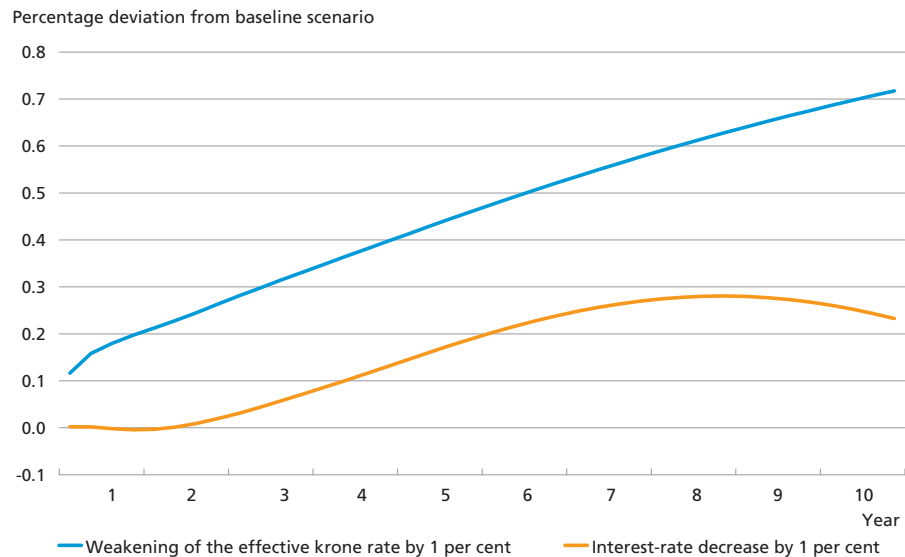


Source: Danmarks Nationalbank.

The effects on activity in the interest-rate experiment can be attributed primarily to private consumption via the housing market, while the activity effects in the exchange-rate experiment can be attributed mainly to exports via improved competitiveness. The effect on consumer prices is far more pronounced in the exchange-rate experiment than in the interest-rate experiment, cf. Chart 5.20. A weakening of the krone

EFFECT ON CONSUMER PRICES

Chart 5.20



Source: Danmarks Nationalbank.

FINANCIAL CONDITIONS INDICES

Box 5.4

A financial conditions index is an indicator of the overall impact of financial conditions on the real economy via their effect on the decisions of households and corporations. It is constructed by weighting selected financial components according to their relative significance to the economy, often determined as the effect on GDP, cf. the discussion in Hansen (1997).

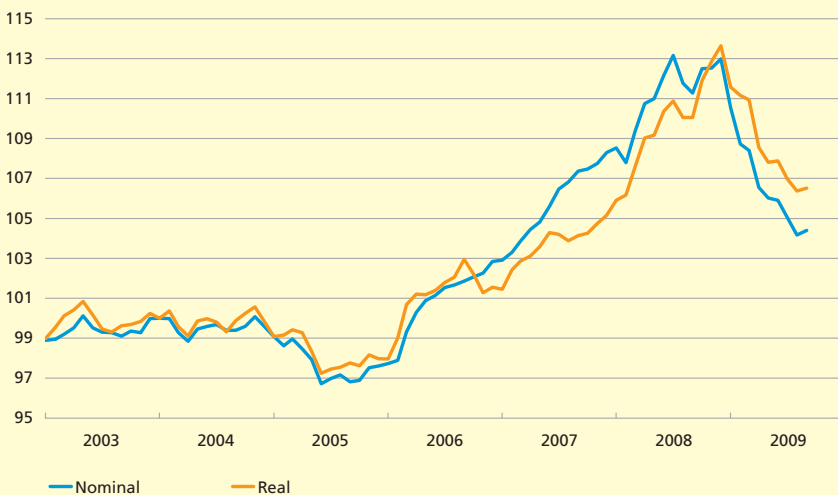
In a Danish context, it seems natural to focus on the development in both short-term and long-term interest rates as well as exchange rates weighted according to their significance to foreign trade. Consequently, a financial conditions index for Denmark can be calculated by weighting a 3-month money-market interest rate, a 30-year mortgage-credit bond yield and the effective krone rate. The three financial variables are weighted according to their relative importance to GDP 1-2 years ahead. In accordance with Denmark's macroeconometrical model, MONA, the effective exchange rate, the short-term interest rate and the long-term yield are weighted on a 1:2:1.5 basis. If interest-rate changes coincide for all maturities, the interest-rate change is thus given a weight that is 3.5 times greater than a corresponding percentage change in the exchange rate. This is consistent with the relative GDP effects after 1-2 years, cf. Chart 5.19.

The financial conditions index can be calculated in both nominal and real terms. In the real index, the real effective krone rate is thus used, while interest rates in both indices are adjusted for an estimate of expected inflation. Chart 5.21 shows the development in the financial conditions index in recent years. The financial conditions in the Danish economy tightened up in 2006-08, reflecting appreciation of the euro and the krone against other currencies as well as rising interest rates.

NOMINAL AND REAL FINANCIAL CONDITIONS INDICES

Chart 5.21

Index, beginning of 2004 = 100



Note: Weighting of the effective krone rate, the 3-month money-market rate and the 30-year mortgage-credit yield on a 1:2:1.5 basis. In the real index, real interest rates have been calculated by deducting Denmark's Nationalbank's own preliminary estimates of the future course of inflation. An increase in the index reflects a tightening of the financial conditions.

Source: Denmark's Nationalbank.

CONTINUED

Box 5.4

The financial conditions index can be seen as an indicator of the tightness of the financial conditions. However, since the sole objective of Danish monetary policy is to keep the krone stable against the euro, the index has no influence on monetary policy. It is one of several instruments used in the ongoing assessment of the overall condition of the real economy.

rate immediately affects consumer prices via import prices, which is the principal reason for the somewhat more marked price effect. In addition, wage costs rise as a result of increasing activity and employment, whereby prices go up. The price effects of a decrease in interest rates can be attributed mainly to higher wage costs, causing prices to rise.

The effects of a temporary increase in interest rates in the euro area and Denmark

This experiment assumes that the ECB raises the monetary-policy interest rates in the euro area by 1 percentage point for two years, compared with a baseline scenario. Danmarks Nationalbank is assumed to follow suit with a parallel increase in Danish monetary-policy interest rates in view of the fixed-exchange-rate policy. After the two years, the monetary-policy interest rates return to the baseline in both the euro area and Denmark.¹

The increase in the monetary-policy interest rates in the euro area is not anticipated by the market in advance. However, the market is assumed correctly to expect the monetary-policy interest rates to return to the baseline after two years. This results in an immediate increase in the 10-year yield by around 0.20 per cent.² The krone follows the euro, and the two currencies are assumed to appreciate by 2 per cent vis-à-vis all other currencies. The effective krone rate thus appreciates by 0.85 per cent. Both long-term interest rates and the effective krone rate are back at the baseline after the two years.

The experiment also considers e.g. that the interest-rate increase and the euro's appreciation dampen growth in the euro area, resulting in lower growth in Danish exports to the euro area.

Table 5.3 summarises the calculations. The higher long-term interest rates lead to falling house prices, which has a negative impact on private consumption. Exports are reduced as a result of the appreciation of the

¹ This interest-rate change and its consequences for the euro area are described in van Els et al. (2001 and 2003). The results are used as input to the calculations in MONA. The experiment with MONA is described in more detail in Danmarks Nationalbank (2003).

² This follows from the expectation hypothesis, since interest rates are increased by 1 per cent in 2 out of 10 years compared with the baseline scenario.

EFFECTS OF A TEMPORARY INTEREST-RATE INCREASE IN THE EURO AREA
AND DENMARK

Table 5.3

Percentage deviation from baseline scenario	Year 1	Year 2	Year 3	Year 4	Year 5
GDP	-0.13	-0.22	-0.18	-0.12	-0.07
Private consumption	0.03	-0.12	-0.16	-0.15	-0.12
Investment	-0.35	-0.81	-0.62	-0.28	-0.04
Exports	-0.36	-0.32	-0.17	-0.08	-0.02
Imports	-0.21	-0.38	-0.26	-0.11	-0.02
Consumer prices	-0.21	-0.20	-0.16	-0.17	-0.19

Source: Danmarks Nationalbank.

effective krone rate and lower demand in the euro area. The overall impact on GDP in the first five years is negative compared with the baseline scenario.

The krone's appreciation leads to falling consumer prices immediately after the interest-rate increase. Furthermore, the reduced economic activity contributes to falling wage levels, which in turn contribute to falling consumer prices in subsequent years relative to the baseline scenario. For a horizon beyond five years the lower wage increases will gradually contribute to a renewed upswing in activity, after which GDP and consumer prices gradually return to the baseline scenario.

5.7 LITERATURE

Andersen, Allan Bødskov (2004), Money Demand in Denmark 1980-2002, Danmarks Nationalbank, *Monetary Review*, 3rd Quarter.

Angeloni, Ignazio, Anil Kashyap and Benoît Mojon (ed.) (2003), *Monetary policy transmission in the euro area*, Cambridge University Press.

Berg, Jesper and Christoffer Kok Sørensen (2005), The Danish Financial System – a Comparison with the Euro Area Member States (in Danish only), *Danmarks Nationalbank Working Papers*, No. 23.

Bernanke, Ben (2006), Reflections on the yield curve and monetary policy, Federal Reserve Board, speech at The Economic Club of New York, 20 March.

Bernanke, Ben and Mark Gertler (1989), Agency costs, net worth, and business fluctuations, *American Economic Review*, Vol. 79, No. 1.

Bernanke, Ben, Mark Gertler and Simon Gilchrist (1999), The financial accelerator in a quantitative business cycle framework. Published in John B. Taylor and Michael Woodford (ed.), *Handbook of Macroeconomics*, North Holland.

Buiter, Willem (2008), Housing wealth isn't wealth, *NBER Working Papers*, No. 14204.

Carlsen, Maria and Charlotte Franck Fæste (2007), The Pass-Through from Danmarks Nationalbank's Interest Rates to the Banks' Retail Interest Rates, Danmarks Nationalbank, *Monetary Review*, 2nd Quarter.

Carlsen, Maria and Johanne Dinesen Riishøj (2006), The Use of Cash in Denmark (in Danish only), *Danmarks Nationalbank Working Papers*, No. 41.

Christensen, Anders Møller and Kristian Kjeldsen (2002), Adjustable-Rate Mortgages, Danmarks Nationalbank, *Monetary Review*, 2nd Quarter.

Dam, Niels Arne, Henrik Hansen and Henrik Christian Olesen (2004), Models of total private consumption in Denmark, *Danish Journal of Economics*, Vol. 142, No. 2.

Danmarks Nationalbank (2003), *MONA – a quarterly model of the Danish economy*.

Deaton, Angus (1992), *Understanding consumption*, Oxford University Press.

Ellingsen, Tore and Ulf Söderström (2001), Monetary policy and market interest rates, *American Economic Review*, Vol. 91, No. 5.

van Els, Peter, Alberto Locarno, Julian Morgan and Jean-Pierre Villetelle (2001), Monetary policy transmission in the euro area: what do aggregate and national structural models tell us?, *ECB Working Papers*, No. 94.

van Els, Peter, Alberto Locarno, Julian Morgan and Jean-Pierre Villetelle (2003), The effects of monetary policy in the euro area: evidence from structural macroeconomic models, published in Ignazio Angeloni et al. (ed.), *Monetary policy transmission in the euro area*, Cambridge University Press.

Freixas, Xavier and Jean-Charles Rochet (2008), *Microeconomics of banking*, MIT Press, 2nd edition.

Friedman, Milton (1957), *A theory of the consumption function*, Princeton University Press.

Hansen, Frank Øland and Dan Knudsen (2004), Correlation patterns in Danish business cycles (in Danish only), *Danish Journal of Economics*, Vol. 142, No. 3.

Hansen, Jakob Lage (2005), Relations between Stock Prices and Bond Yields, Danmarks Nationalbank, *Monetary Review*, 1st Quarter.

Hansen, Niels Lynggaard (1997), Monetary Conditions Indices, Danmarks Nationalbank, *Monetary Review*, 2nd Quarter.

Heuvel, Skander van den (2002), Does bank capital matter for monetary transmission?, Federal Reserve Bank of New York, *Economic Policy Review*, Vol. 8, No. 1.

Knudsen, Dan (2002), Measuring expected inflation and the real rate of interest (in Danish only), *Danish Journal of Economics*, Vol. 140, No. 1.

Knudsen, Ulrik (2003), Conversions of 30-Year Mortgage-Credit Bonds during the Last 10 Years, Danmarks Nationalbank, *Monetary Review*, 2nd Quarter.

Kuttner, Kenneth og Patricia Mosser (2002), The monetary transmission mechanism: some answers and further questions, Federal Reserve Bank of New York, *Economic Policy Review*, Vol. 8, No. 1.

Ludwig, Alexander and Torsten Sløk (2004), The relationship between stock prices, house prices and consumption in OECD countries, *Topics in Macroeconomics*, Vol. 4, No. 1.

Modigliani, Franco and Richard Brumberg (1954), Utility analysis and the consumption function. Published in Kenneth Kurihara (ed.), *Post-Keynesian Economics*, Rutgers University Press.

Modigliani, Franco and Richard Brumberg (1980), Utility analysis and aggregate consumption functions: an attempt at integration. Published in Andrew Abel (ed.), *The collected papers of Franco Modigliani: Vol. 2, the life cycle hypothesis of saving*, MIT Press.

Nielsen, Heino Bohn (1999), Market Shares of Manufactured Exports and Competitiveness, Danmarks Nationalbank, *Monetary Review*, 2nd Quarter.

Olesen, Jan Overgaard (2008), A consumption relation for households (in Danish only), *Danmarks Nationalbank Working Papers*, No. 51.

Olesen, Jan Overgaard and Erik Haller Pedersen (2006), A compilation of housing wealth (in Danish only), *Danmarks Nationalbank Working Papers*, No. 37.

Pedersen, Erik Haller (2001), Development in and Measurement of the Real Interest Rate, Danmarks Nationalbank, *Monetary Review*, 3rd Quarter.

Pedersen, Erik Haller (2004), Revision of the Weights for Calculation of Danmarks Nationalbank's Effective Krone-Rate Index, Danmarks Nationalbank, *Monetary Review*, 4th Quarter.

Pedersen, Erik Haller (2007), The Effective Krone Rate and Trade in Services, Danmarks Nationalbank, *Monetary Review*, 3rd Quarter.

Pedersen, Anders Mølgaard (2003), The Credit Channel in Monetary-Policy Analyses, Danmarks Nationalbank, *Monetary Review*, 4th Quarter.

Pedersen, Lisbeth Stausholm (1997), Market Reactions to Changes in the Danish Discount Rate, Danmarks Nationalbank, *Monetary Review*, 3rd Quarter.

Risbjerg, Lars (2006a), Trends in Mortgage-Credit Financing: Household Consumption, Danmarks Nationalbank, *Monetary Review*, 1st Quarter.

Risbjerg, Lars (2006b), Money Growth, Inflation and the Business Cycle, Danmarks Nationalbank, *Monetary Review*, 3rd Quarter.

Petersen, Christina and Lars Risbjerg (2009), The financing of Danish corporations in a macroeconomic perspective (in Danish only), *Danmarks Nationalbank Working Papers*, No. 62.

Sørensen, Søren Vester (2008), Real effective equilibrium exchange rates for Denmark (in Danish only), *Danmarks Nationalbank Working Papers*, No. 58.

Saabye, Niki (2003), The Equity Risk Premium, Danmarks Nationalbank, *Monetary Review*, 1st Quarter.

Woodford, Michael (2003), *Interest and prices*, Princeton University Press.