MONEY, CREDIT AND BANKING

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INTRODUCTION AND SUMMARY

Money is at the core of modern society, not least due to its role in the many different transactions made by households and firms every day. The transactions range from small everyday purchases to large-scale financial transactions. Against this backdrop, the money stock, i.e. households' and firms' holdings of money, attracts interest. This article discusses what money is and what drives the money stock. The development in the money stock is closely linked to lending by banks and mortgage banks, which is also considered.[1]

Money is essentially liquid claims that are stable in value and can also serve as a unit of account. Besides cash, i.e. banknotes and coins, the standard definitions of money also include other liquid claims such as bank deposits. This reflects that deposits can be used as a means of payment alongside cash. In practice, there is not one overall monetary aggregate, just as the relevant definition of money has been amended over time. Prior to last century's increasing use of bank deposits and cheque payments, money was equivalent to cash.

While banknotes and coins are issued by Danmarks Nationalbank, the remainder of the money stock is the result of transactions between actors in the private sector. For example, when a household or firm raises a bank loan, this transaction will often, in the first instance, lead to higher bank deposits and thus an increase in the money stock. But this does not imply a one-to-one relationship between bank deposits and lending. Other customers may increase their deposits as they sell securities to banks, and banks may fund their lending through sources other than deposits. Banks' composition of funding depends, inter alia, on costs and risk.

The growth in money and credit is influenced by a number of factors, such as demand from households and firms, market conditions, the regulatory framework for the financial sector and Danmarks Nationalbank's monetary policy. A well-functioning financial sector is crucial for enabling money and credit to adjust to the demand from households and firms. In this article we use simple empirical models to illustrate some of the determinants of money and credit in Denmark.

The need for both money and credit is closely linked to the transactions of households and firms. Consequently, it is not surprising that domestic demand, which reflects the volume of transactions, can contribute to explaining the development in both the money stock and lending. Property prices also play a role in the demand for and access to money and credit, and so do interest rates.

Generally, banks determine interest rates and other conditions for their deposits with a view to achieving the highest possible return, taking into account the associated risks. Ultimately, the private sector's demand for money is determined by the current monetary policy. The reason is that monetary policy determines the level of interest rates, which has a direct impact on the costs of raising a loan. Monetary policy also influences

1 See also McLeay et al. (2014a and 2014b) for a thorough introduction to money and banking in a modern economy.

economic activity and thus the transaction need of households and firms, which is decisive for the demand for money and credit.

MONEY

Money is essentially liquid claims. The narrowest definition comprises banknotes and coins in circulation. In the past, banknotes and coins could generally be exchanged for gold at the central bank, but today money, including Danish kroner, is not supported by underlying physical assets. Its value is solely based on trust in the monetary system. Households and firms are willing to receive money as payment, because they trust that money is stable in value, and that they can subsequently use it as a means of payment.

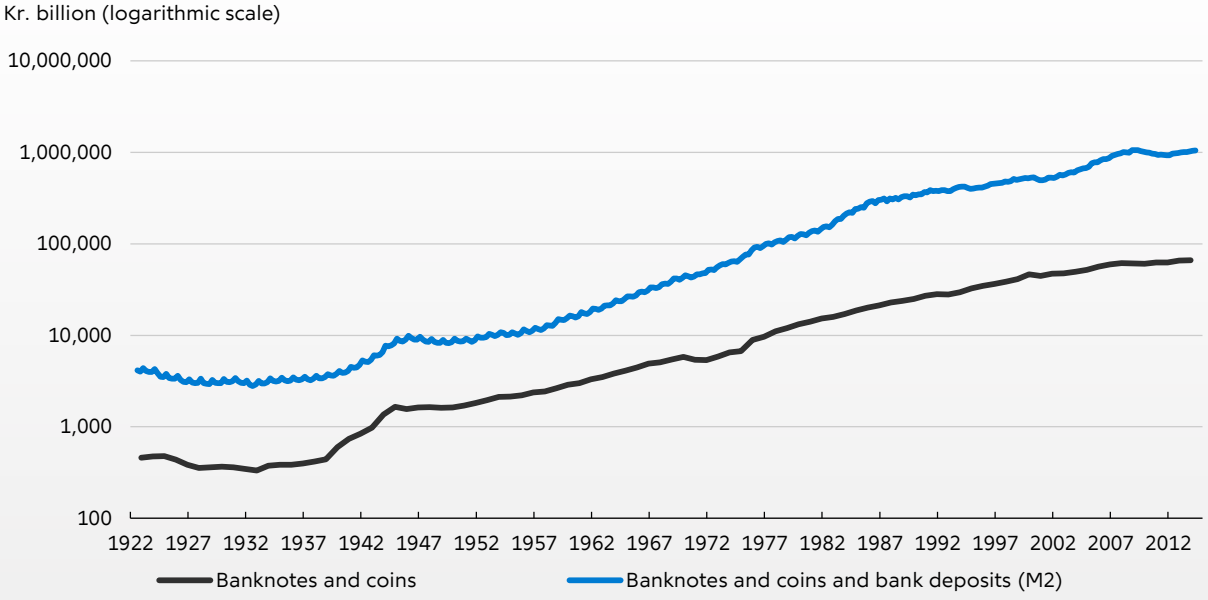
The amount of money held by Danish residents is far larger today than 100 years ago, cf. Chart 1, reflecting, inter alia, a higher number of transactions involving money and higher prices of goods and services. At the same time, developments in the monetary and financial system have played a key role.

The incentive for households and firms to hold money reflects the three basic characteristics of money. Firstly, it can be used as a store of value. If a household or firm wants to accumulate savings, holding money is an option. Hence, the value or purchasing power of money must be stable. Consequently, e.g. equities and long-term bonds are not counted as money in the official statistics, as their value fluctuates over time in step with fluctuations in interest rates and the business cycle.

Secondly, money must be suitable for use as a measuring unit for prices. For example, in Denmark prices are measured in kroner. Thirdly, money must be liquid and serve as a means of payment. In Denmark, kroner are legal tender under the Danmarks Nationalbank Act and the Coinage Act. This means that a debtor – except in rare cases stipulated in the legislation – can always redeem debt by using Danish kroner. A creditor, on the other hand, is not obliged to e.g. receive goods and services or foreign money.

In principle, transactions could take place by barter of goods and services. For example, a farmer wanting a haircut could pay the hairdresser in milk or meat. Barter trade may work well in a primitive economy with only a small number of goods and services that are to a certain extent demanded by everybody. But a modern economy depends on the existence of a means of payment

Money stock in Denmark since 1922 Chart 1



Note: The curve for banknotes and coins also includes the holdings of banks, mortgage banks and the central government, which are not included in the official definitions of the money stock. Annual data for banknotes and coins and quarterly data for M2.
Source: Abildgren (2006 and 2012) and Danmarks Nationalbank.

Consumer price inflation in Denmark Chart 2

Note: Annual rates of increase in the consumer price index, CPI.
Source: Statistics Denmark.

which everybody agrees to use. Money is such a means of payment.

Confidence in Danish kroner reflects confidence in Danmarks Nationalbank. The population expects Danmarks Nationalbank to ensure, via its monetary policy, that the value of the krone is stable over time. Inflation has been very stable over a long period, cf. Chart 2. This is the result of maintaining a fixed exchange rate of the krone vis-à-vis first the D-mark, then the euro. The European Central Bank, ECB, conducts monetary policy with a view to ensuring price stability in the euro area, meaning that prices will be stable in Denmark too.

MONEY STOCK

The money stock is a measure of households' and firms' holdings of liquid claims. In practice, there is not one overall monetary aggregate that can provide a clear picture of liquidity conditions in the economy. It is difficult to determine the characteristics that distinguish money from other financial assets, since there are no hard-and-fast boundaries between liquidity, stability in value and return from cash to bonds and e.g. equities.

The liquidity of the individual claims and hence the composition of what can be characterised as money is determined by households and firms via their transaction patterns. Consequently, the relevant definition of money has evolved over time. For example, last century's increased use of bank deposits and cheques led to a broadening of the relevant monetary aggregate, which had previously comprised only cash. Today, households most often make payments by credit transfer from the buyer's to the seller's bank, e.g. using the Dankort, and demand deposits at the banks have the three basic characteristics of money alongside cash.

Looking ahead, the relevant definition of money may evolve further in line with innovations in the financial sector. The crux of the matter is that the framework for the sector enables households and firms to allocate their financial assets and liabilities appropriately, while taking liquidity, return and risk into account.

In a data context, three monetary aggregates normally apply. M1 comprises banknotes and coins in circulation as well as demand deposits at banks. M2 also includes time deposits with an original maturity of up to and including 2 years as well as deposits redeemable at notice up to and including 3 months. Finally, M3 comprises, in addition, deposits from repo transactions[2] and bonds

2 In a repo transaction, securities are sold for cash, and at the same time an agreement is concluded on repurchase from the counterparty at an agreed price at a future time.

issued by the MFI sector with an original maturity of up to and including 2 years.[3] Box 1 illustrates the division into money and other claims and the sectors playing the most important role for the money stock.

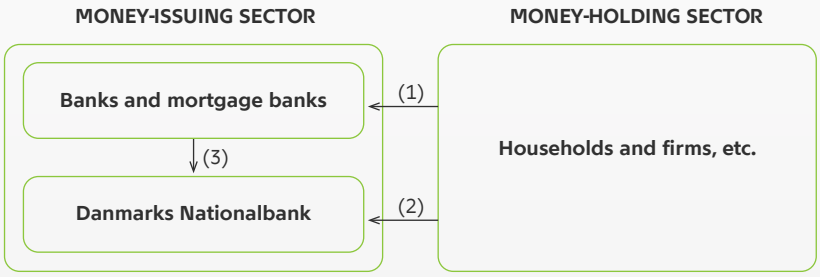
In Denmark, M3 totalled approximately kr. 1,250 billion in July 2014. Of this amount, bank-notes and coins issued by Danmarks Nationalbank accounted for kr. 56 billion, while bank deposits, etc. accounted for the remaining approximately kr. 1,200 billion, cf. Chart 3. The largest share by far of the money stock is thus the result of transactions between actors in the private sector without involving Danmarks Nationalbank.

Composition of monetary aggregates

Box 1

Financial claims can be ranked in a hierarchy according to liquidity and stability in value. Money is characterised by a high degree of liquidity and stability in value, and the higher the degree of liquidity and stability in value, the narrower the monetary aggregate. The money stock is also limited by the sector issuing the claim (the money-issuing sector) and the sector holding the claim (the money-holding sector). The money-issuing sector comprises the financial institutions whose liquid liabilities are included in the definition of money. These are banks and mortgage banks and Danmarks Nationalbank, overall called the MFI sector. The money-holding sector comprises Danish households and firms (excluding banks and mortgage banks) as well as local and regional authorities, cf. the chart below. The central government is regarded as neutral in a money context.

Financial claims by sector



Note: The arrow points to the sector on which the money represents a claim.

The table below shows which claims are included in the various monetary aggregates and provides examples of claims not included in the money stock. The last column in the table indicates where in the chart the claim is shown. M1, M2 and M3 consist of the money-holding sector's claims on the money-issuing sector, cf. (1) and (2) in the chart.

The money stock is determined on the basis of the consolidated balance sheet for the MFI sector. This excludes inter-MFI accounts. Since mortgage banks are part of the money-issuing sector, short-term mortgage bonds held by the money-holding sector are included in M3. The status of mortgage banks as part of the money-issuing sector also means that banks' purchases of mortgage bonds from mortgage banks have no impact on the money stock. Bonds issued by mortgage banks are offset by banks' holdings of these bonds. Similarly, the consolidated balance sheet is not affected by payments for the bonds debited to the bank's current account at Danmarks Nationalbank and credited to the mortgage bank's account.

Financial entities other than banks and mortgage banks, e.g. pension companies, are not included in the money-issuing sector, but in the money-holding sector instead. Household pension savings are offset by the pension companies' pension commitments and have no impact on the money stock.

The counterparts of the money stock are the items on the consolidated balance sheet of the MFI sector that are not included in the money stock. Examples are lending by banks and mortgage banks to non-MFIs, the banks' securities portfolios and their international position. By definition, a change in the money stock will be reflected in its counterparts.

3 The MFI sector covers the banks and mortgage banks and Danmarks Nationalbank. The development in M3 is influenced by the issuance of short-term bonds for financing of adjustable rate loans, which may result in substantial fluctuations. For Denmark, the information content of M3 is thus often modest.

Financial claims and the money stock Box 1 continued

	M1	M2	M3	Arrow in chart
Banknotes and coins in circulation	X	X	X	(2)
Demand deposits at banks	X	X	X	(1)
Time deposits at banks		X	X	(1)
Bank deposits redeemable at notice		X	X	(1)
Bank deposits from repos			X	(1)
Short-term bonds issued by banks and mortgage banks			X	(1)
Other bonds				
Equities				
Pension savings				

In the monetary base, the money-issuing sector is limited to Danmarks Nationalbank. The monetary base consists of banks' and mortgage banks' liquid claims on Danmarks Nationalbank in the form of current account deposits, certificates of deposit and banknotes and coins, cf. (3) in the chart. In addition, the money-holding sector's holdings of banknotes and coins are also included in the monetary base, cf. (2) in the chart.

While banknotes and coins represent claims on Danmarks Nationalbank, bank deposits from households and firms represent claims on the private financial sector. The depositors thus depend on the banks being able and willing to meet their obligations. In practice, bank deposits are perceived as just as safe as cash. A case in point is that the Guarantee Fund for Depositors and Investors guarantees deposits of up to 100,000 euro or around kr. 750,000.

Households and firms continually consider the allocation of their financial assets between cash, bank deposits and investment in financial claims. Households' holdings of cash and bank deposits represent around 17 per cent of their financial assets, cf. Chart 4. The largest items are equity portfolios and pensions.

Money is thus only a sub-component of households' total financial wealth. The extent to which this component plays a special role in the economy, given its liquidity, is an empirical question. Equities, for instance, can easily be sold by a household in need of liquidity. Besides financial wealth, households also have substantial housing wealth. Their liabilities are primarily composed of bank and mortgage bank loans.

MONETARY BASE

A discussion of money is not complete without considering the monetary base. It is often called M0 and consists of cash and liquid bank deposits at the central bank. As regards Denmark, the latter are the banks' current account deposits, which are subject to the current account limits. However, it can be argued that certificates of deposit held by monetary policy counterparties should also be included in the monetary base. The argument is that Danmarks Nationalbank will buy back certificates of deposit if current account liquidity becomes too low.[4]

The monetary base and central bank balance sheets

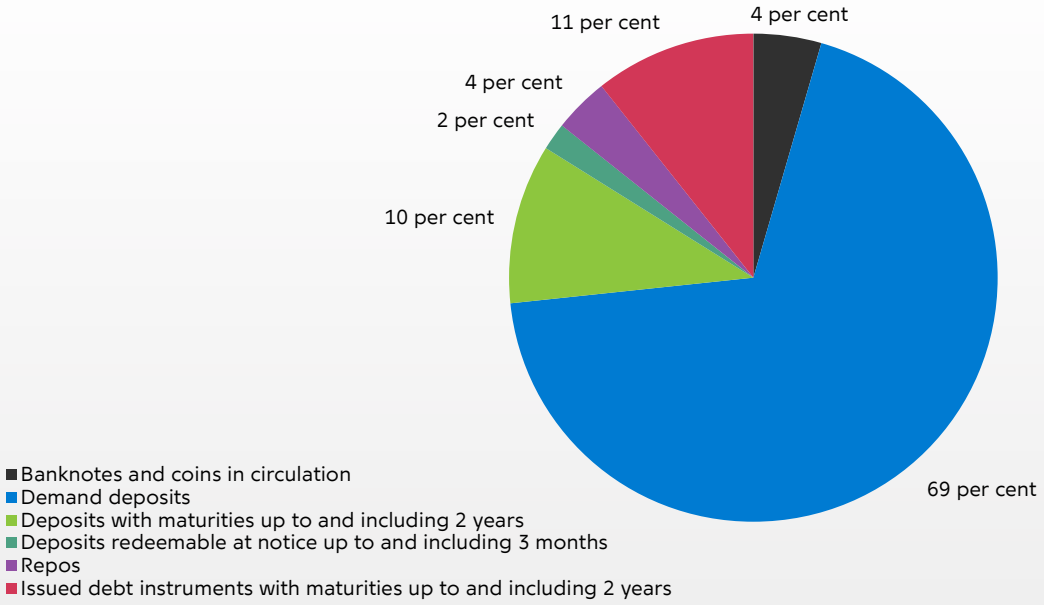
The monetary base grew strongly in 2008 in several countries during the financial crisis.[5] The rise in the euro area monetary base primarily reflected the ECB's improvement of the banks' access to borrow from the ECB. As a result, monetary policy lending increased. In Denmark, the banks' depos-

4 See Spange and Toftdahl (2014) for an introduction to Danmarks Nationalbank's implementation of monetary policy.

5 For a discussion of the development in the monetary base in a number of countries in connection with the financial crisis, see Anderson et al. (2010).

Composition of M3, July 2014

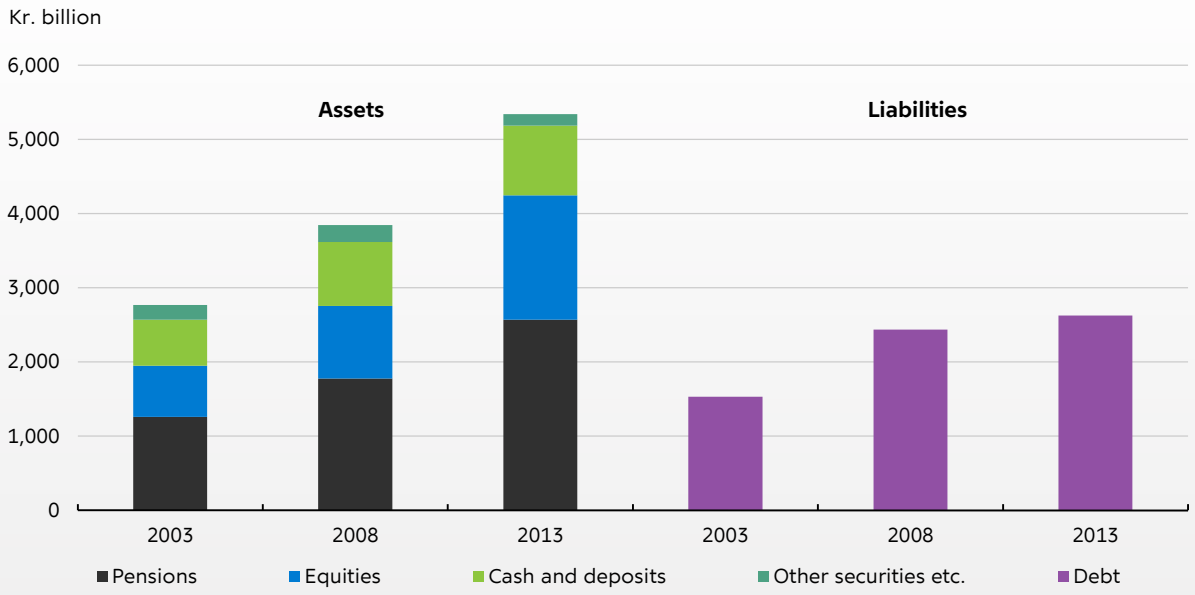
Chart 3



Source: Danmarks Nationalbank.

Households' financial assets and liabilities

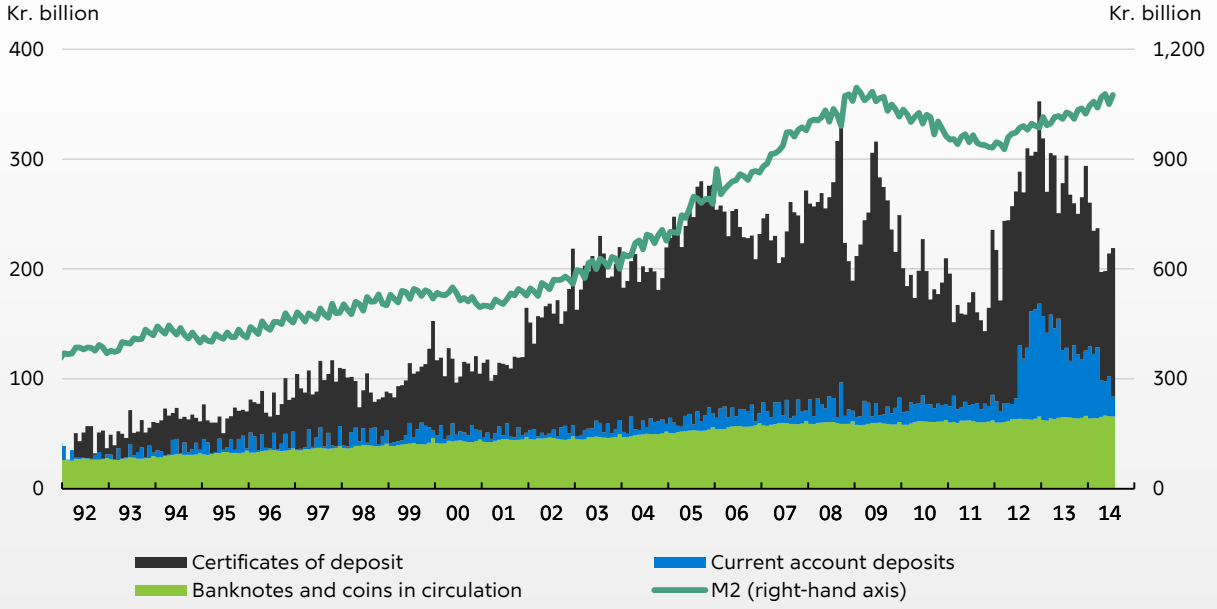
Chart 4



Note: The pension portfolio has been calculated before tax. Other securities, etc. include, inter alia, bonds and other accounts receivable/payable. Debt comprises all household liabilities. End-of-period, seasonally adjusted data. A data break occurred in 2013 due to the transition to new MFI statistics.

Source: Danmarks Nationalbank.

Monetary base and money stock in Denmark Chart 5



Note: Monthly observations.
Source: Danmarks Nationalbank.

its at Danmarks Nationalbank rose considerably from the onset of the financial turmoil in the summer of 2007 to the autumn of 2008, cf. Chart 5, while monetary policy lending increased. The growth in monetary policy lending and deposits was attributable to an increase in certificates of deposit, which constitutes a liquidity buffer that the banks may use for raising liquidity in Danmarks Nationalbank's open market operations.

Any change in the monetary base is mirrored by changes in other items on a central bank balance sheet. By definition, more central bank lending will be reflected in larger deposits at the central bank, if the other items remain unchanged. As a result, the central bank cannot provide net funding to the banks overall by increasing its lending. Individual banks may increase net borrowing from the central bank, but this will be offset by other banks' reduction of their net loans from the central bank.

However, enhanced access to monetary policy loans, which will increase central bank lending and deposits, may support the banks' lending to households and firms. This will be effected partly through greater certainty for the banks about their liquidity situation and partly by ensuring funding access for banks that find it difficult to borrow in the market.

An increase in the monetary base may also reflect changes in items of central banks' balance sheets other than monetary policy lending. Items other than monetary policy lending and deposits are denoted the autonomous factors. On the assets side, these include e.g. the foreign exchange reserve and the central bank's portfolio of domestic securities. An example on the liabilities side is the central government's account at the central bank. For example, the increase in the US monetary base is primarily attributable to the large-scale asset purchases by the Federal Reserve. The Fed buys assets from the banks, resulting in a rise in the banks' deposits at the Fed.

In Denmark, the fluctuations in the monetary base since the onset of the financial crisis are very much attributable to fluctuations in the foreign exchange reserve, cf. Dam and Risbjerg (2009). The monetary base dived in late 2008 in connection with considerable intervention sales of foreign exchange in October.[6] It then rose as the foreign exchange reserve grew. When Danmarks Nationalbank buys foreign exchange from the banks, the

6 The central government's issuance of a 30-year bond in December 2008 also reduced bank deposits at Danmarks Nationalbank in connection with an increase in the balance of the central government's account at Danmarks Nationalbank.

banks' current accounts are credited, and their deposits at Danmarks Nationalbank are increased.

The monetary base declined from the middle of 2009, when Danmarks Nationalbank introduced a margin between the interest rates on monetary policy loans and certificates of deposit. The aim was to induce the banks exchange liquidity among themselves rather than resorting to Danmarks Nationalbank's lending and deposit facilities. This reduced monetary policy lending and deposits, and the gross positions had all but vanished at the beginning of 2010.

The increase in the monetary base during 2012 was the result of Danmarks Nationalbank's considerable purchases of foreign exchange due to the tendency for the krone to strengthen, brought about by the sovereign debt crisis in several euro area member states.[7] In addition, Danmarks Nationalbank gave access to 3-year loans, entailing a small increase in monetary policy lending and deposits. The most recent declining trend can be attributed to such factors as redemption of 3-year loans and a reduction of the foreign exchange reserve.

The relatively substantial fluctuations in the current account balance since mid-2012 are linked to the adjustment of the current account limits as Danmarks Nationalbank's rate of interest on certificates of deposit became negative and positive again in early 2014.[8]

Monetary base, money stock and lending by banks

Some expositions seem to indicate that an increase in the monetary base will give the banks extra funds for lending, and that there is a close link between the monetary base and lending by banks.[9] This link is often expressed by the credit multiplier model, according to which the central bank can control the banks' lending and the money stock via the monetary base.[10] According to the model, an increase in the monetary base entails growth in the money stock and bank lending, and a stable relationship is assumed to exist between the monetary base and the money stock and bank lending, respectively.

The credit multiplier model is based on an isolated view of the banks' accounts with the central bank and their deposits and lending without considering the banks' other activities. Such a description is too simple.

In practice, the monetary base has no considerable influence on the size of the money stock or lending by banks. Danmarks Nationalbank does not control the money stock and bank lending via the monetary base. In contrast, Danmarks Nationalbank is willing to accommodate private sector demand for cash, and the banks are free to decide their total deposits at Danmarks Nationalbank by buying certificates of deposit via the weekly open market operations. There is a cap on the banks' total current account deposits in order to limit liquidity that can be readily used for speculation against the krone. Central bank deposits can be seen as one of more liquid assets on the banks' balance sheets. Fluctuations in the monetary base do not contribute to the statistical prediction of fluctuations in the money stock and bank lending either.[11]

BANK BALANCE SHEETS

Banks play a key role in the development of the money stock, and deposits from households and firms constitute the largest liability on the banks' balance sheets, cf. Chart 6. Lending by banks is the largest counterpart of deposits. The composition of their assets and liabilities reflects the interaction between banks and other financial and non-financial actors in the economy, including households, non-financial corporations and mortgage banks. This means that the development in the banks' deposits and lending, and hence the money stock, is the result of a great variety of transactions.

7 Cf. Jørgensen and Risbjerg (2013).

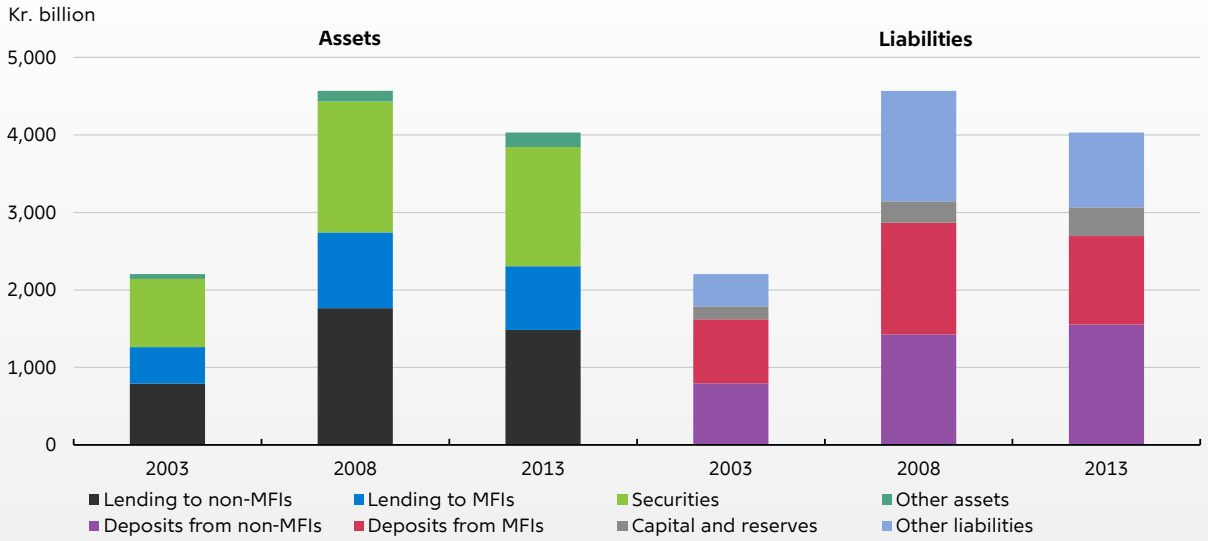
8 Cf. Jørgensen and Risbjerg (2012).

9 Borio and Disyatat (2009) refer to this view, but dismiss the existence of such a close link.

10 The model is reviewed in Mishkin (2004).

11 The ability of the monetary base to predict the development in the money stock and bank lending has been examined specifically via Granger causality tests. These tests seek to explain changes in, respectively, bank deposits that are included in the money stock, and bank lending by the banks' own lagged changes and changes in their deposits at Danmarks Nationalbank. The hypothesis that changes in bank deposits at Danmarks Nationalbank do not contribute to predicting changes in deposits and lending, respectively, cannot be rejected.

The banks' balance sheet Chart 6



Note: End-of-period data. A data break occurred in 2013 due to the transition to new MFI statistics. Securities include bonds, equities, derivatives and certificates of deposit issued by Danmarks Nationalbank. Lending to and deposits from MFIs include e.g. accounts with MFIs' foreign units and central banks except purchases of certificates of deposit from Danmarks Nationalbank. Other assets include e.g. cash in hand. Other liabilities include, inter alia, debt instruments issued and derivatives. The balance sheet is not consolidated.
Source: Danmarks Nationalbank.

On the liabilities side, banks can fund their lending by using deposits, but also by borrowing funds in the money and capital markets. The banks used the latter option to a considerable extent up to 2008, when growth in deposits lagged behind lending growth. The result was a substantial customer funding gap in the Danish banking sector overall, which was funded via borrowing abroad. The customer funding gap has subsequently been reversed to a customer funding surplus.

The composition of the banks' funding depends on such factors as costs and risk. For example, banks can increase their funding via deposits by raising the deposit rate and thus induce households and firms to make more deposits. In general, banks' deposits are determined by the demand from households and firms for transaction money and by the return on deposits compared with the return on investment in other financial claims. On the assets side, lending is determined by the demand for loans and by the banks' assessment of return against risk on lending.

BANK LENDING AND THE STOCK OF MONEY

Given the structure of the banking system, lending normally generates deposits. When a bank grants a loan to a household or firm, the loan proceeds will first be credited to the borrower's bank account. This means that lending will initially be offset by a corresponding deposit and thus by an increase in the money stock. After that, there are several possibilities as regards the deposit.

One possibility is for it to remain unchanged, resulting in a permanent effect on the money stock. Alternatively, it can be used to repay other debt to the banking sector, generating a short-lived increase in the money stock. Loans are often raised to pay for products, services or investment goods. This typically means transferring the amount to an account belonging to another household or firm.

If the loan proceeds are used for payment purposes, the payee will, in some cases, take the opportunity to redeem its own bank debt. This reduces the money stock again. The payee may also choose to leave the money as a deposit in his own bank account or to spend it. The further effects on the money stock depend on what the next money recipient decides to do.

The money stock is not only affected by lending. Deposits, and hence the money stock, are affected every time a household or firm buys or sells financial assets, which are not included in the monetary aggregates, from or to the bank-

ing sector (including Danmarks Nationalbank). If, for instance, a household buys a bond from its bank, that household's deposits, and hence the money stock, will be reduced by an amount equivalent to the bond value. Moreover, deposits are continually transferred between residents and non-residents. Non-residents' deposits at Danish banks are not included in the money stock, which is therefore affected by such transfers.

Mortgage bank lending also influences the money stock. When a household or firm raises a loan from a mortgage bank, the proceeds are initially credited to the borrower's bank account. Mortgage banks fund their lending by issuing mortgage bonds. The asset generated on the mortgage bank's balance sheet is thus offset by an increase in bonds issued on the liabilities side. The bonds may be bought by a bank, in which case they will appear on that bank's assets side and offset the increase in the bank's deposits generated by the loan. Such purchases have no effect on the money stock.

THE BANKS AND THE ECONOMY

The principal function of banks is to channel liquidity from depositors to borrowers. Since deposits often have short or no maturities, while loans have longer maturities, this entails maturity transformation at the banks. In their role as lenders, banks must assess the creditworthiness of potential new borrowers, just as they have to monitor regularly whether existing borrowers service their loans. The banks often develop long-term relations with their customers, thereby facilitating this process.

The banks are able to spread the risk due to the large number of customers. If, instead, lending took place directly between households and firms, the individual lenders would be far more sensitive to the ability of the individual borrowers to service their debt.

A well-functioning banking system has scope for growth in deposits and lending in situations with considerable demand for liquidity from households and firms. This enables firms to obtain the loans they need for investment purposes. The financial sector also contributes to the households' ability to plan their consumption profiles over time, i.e. they may allow consumption to exceed income in low-income periods and service the resulting debt in periods when income is higher. This is also relevant when buying e.g. a house or a car.

The importance of a well-functioning banking system is underpinned by the experience of various types of financial sector crises. Reinhard and Rogoff (2009) show that severe banking crises are typically associated with deep, persistent real economic slowdowns. Furthermore, cross-country studies indicate that a financial sector of a certain size contributes positively to a country's economic growth. But there are also indications that the financial sector can get too big and attract inappropriately large resources away from the rest of the economy, where they could have been used more productively.[12]

FACTORS BEHIND DEVELOPMENTS IN MONEY AND CREDIT

Overall, developments in money and credit are determined by demand from households and firms and by the market conditions in the banking sector in general, including the regulatory framework for the financial sector. However, the private sector's money demand is ultimately determined by monetary policy. This applies even though monetary policy does not explicitly take the development in the money stock into account. The following sections shed light on the effects of the various factors as regards money and credit.

DEMAND FOR MONEY AND LOANS

Bank deposits and lending are to a high degree determined by demand from households and firms, given the deposit and lending rates set by the banks. To illustrate this, we construct and estimate two simple empirical demand models for Denmark, one for money demand and one for demand for loans. The models are mutually independent, but contain some of the same explanatory variables, such as domestic demand, which is a measure of economic activity, and property wealth.

12 See Abildgren et al. (2013) and the references in that publication.

Money demand

Money demand in Denmark can be described in terms of domestic demand, the deposit rate, the 30-year mortgage yield and household property wealth, cf. Box 2.[13] According to the model, money demand grows along with domestic demand. The reason is that the transaction need increases. Money demand also rises if the deposit rate goes up. A rise in the 30-year mortgage yield entails higher opportunity costs of holding money, causing money demand to fall. The model also shows that an increase in property wealth entails stronger money demand.

In a Danish context the demand for money was most recently modelled by Andersen (2004). That analysis did not comprise property wealth. However, the model is unable to capture the strong growth in the money stock seen after 2002. The challenges of describing money demand after 2002 are not an isolated Danish phenomenon. As regards the USA and the euro area, there are indications that it can be explained until 2007 by including property wealth, cf., inter alia, Greiber and Setzer (2007) and Beyer (2009). This is also the case for Denmark, since the description of the money stock development is notably enhanced by including property wealth in the model.

The link between property wealth and money demand can be attributed to several factors. Firstly, increases in property wealth typically coincide with higher turnover in the housing market. This may lead to higher demand for housing loans, which will, to some extent, result in deposit growth. Secondly, higher property wealth may cause households and firms to change the composition of their balance sheets via a wealth effect, which may entail changes in the demand for money and loans. Thirdly, a rise in property wealth will increase the value of the collateral pledged by households and firms and thus improve borrowing access, just as higher house prices, all else equal, increase the amount which a potential buyer needs to borrow. Higher lending will typically be followed by greater deposits, which will increase the money stock.

In Denmark, these links may be reinforced by the product development in home financing in the early 2000s. According to Dam et al. (2011), more than half of the strong increase in house prices in the 2000s can be explained by the pronounced growth in the use of adjustable rate loans and deferred amortisation loans. These two products played almost equal roles. In addition, in 2003 the banks introduced mortgage loans against the home as collateral, which may also have contributed to the growth in both lending and deposits.[14]

Demand for loans

Lending in Denmark can be described using a simple model containing domestic demand, the lending rate and property wealth.[15] The model shows that lending rises, all else equal, in step with growth in domestic demand, because this increases the demand for funds for financial transaction purposes, e.g. investments. Moreover, higher economic activity may be an indicator of higher future incomes. In so far as households take future incomes into account in their consumption planning, this may increase the demand for loans.

The model also shows that lending falls if the lending rate rises. In addition, there is a positive relationship between property wealth and lending. Higher wealth improves the access to borrow since the wealth can be used as collateral for the loan. Rising property prices may also increase the demand for loans for the purchase of real property.

In general, the model provides a good description of developments in lending, but it falls short of explaining the extraordinary large extension of credit in the run-up to the financial crisis. Estimated lending tends to be lower than actual lending in the period 2005-07. This period was characterised by soaring house prices, but this is not enough to explain the whole increase in lending. The model's inability to explain lending in that period indicates that credit policies of banks and mortgage banks were too lenient.

13 Money demand in Denmark was previously estimated by Christensen and Jensen (1987), Hansen (1996) and Andersen (2004).

14 See Risbjerg (2006) for a discussion of the link between the money stock and housing loans.

15 For similar estimations for other countries, see e.g. Calza, Manrique and Sousa (2006), Gerlach and Peng (2005), Hofmann (2003 and 2004) and Addison-Smyth, McQuinn and O'Reilly (2009).

Estimation of demand for money and loans

Box 2

The demand for money and loans is estimated using two error correction models, estimated separately. It is thus not one overall portfolio model, but individual models for two of the most important assets and liabilities of households and firms. The models can be written as:

$$\Delta y_t = \alpha x_{t-1} + \sum_{i=1}^{k} \beta_i \Delta x_{t-i} + \omega_t \quad (1)$$

The left-hand variable y_t is the money stock in one model and lending by banks and mortgage banks to households and non-financial corporations in the other. The first term after the equal sign, αx_{t-1}, consists of a vector of adjustment coefficients α and the model vector of variables x_t and expresses the model's long-run relationship. The next term after the equal sign contains the short-run dynamics, where k is the number of lags. The last term, ω_t, denotes the residuals, which are assumed to be identical and independently normally distributed. The following data vectors have been applied to the demand for loans and money, respectively:

$$x'_t = (m2_t, ytr_t, R_t^{dep}, R_t^{alt}, wh_t)$$

$$x'_t = (lending_t, ytr_t, R_t^{lend}, we_t)$$

In the top vector, $m2_t$ denotes the money stock, ytr_t is domestic demand, R_t^{dep} is the banks' deposit rate, R_t^{alt} is the alternative return to placing funds in deposit accounts, while wh_t denotes household property wealth. In the bottom vector, $lending_t$ denotes total lending by banks and mortgage banks to households and non-financial corporations. R_t^{lend} is the banks' and mortgage banks' weighted lending rate, and we_t is property wealth compiled as the sum of household property wealth and the market value of commercial properties.

Lowercase letters denote variables in logarithms. The estimation period is Q1 1981-Q3 2013, and all series except interest rates are seasonally adjusted and included in nominal terms. This is in accordance with the analysis in Andersen (2004). Basically, we use four lags for the first order differences as the data is quarterly data. Variables are then removed from the relation on the basis of statistical criteria.

Money demand

Estimation of error correction model (1) leads to the following long-run relationship for money demand:

$$m2_t = \alpha + 0{,}94^{**} ytr_t + 5{,}49^{***} R_t^{dep} - 3{,}54^{**} R_t^{RI30} + 0{,}30^{**} wh_t$$

In the equation, *, ** and *** denote significance levels of 10 per cent, 5 per cent and 1 per cent, respectively. All variables have with the expected signs and are significant at a level of either 1 per cent or 5 per cent. There are indications of error correction in the model, in that money demand will tend to return to its long-run level after being hit by a shock. The results indicate that any deviation between actual money demand and its long-run level narrows by approximately 10 per cent per quarter.

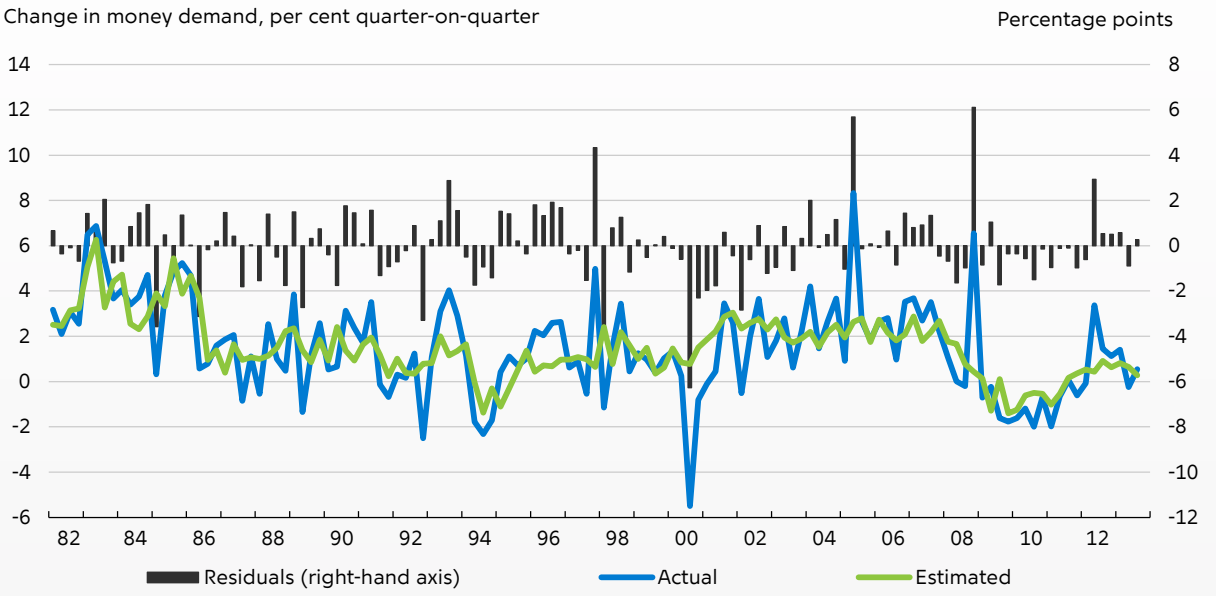
The estimate on domestic demand indicates that the elasticity of money demand as regards transaction volume is close to 1. This means that money demand moves along with the transaction need in the long run, which is in accordance with previous analyses of money demand in Denmark. The deposit rate is strongly significant, and the estimate shows an increase of approximately 5.5 per cent in money demand if the deposit rate rises by 1 percentage point.

As regards the alternative interest rate, the 30-year mortgage yield, R_t^{RI30}, has the best properties for the model. The widespread use of mortgage credit in Denmark enables households to either buy mortgage bonds or service their mortgages rather than place funds in their deposit accounts, if mortgage yields go up. This causes money demand to fall. Finally, household property wealth also turns out to be significant with a coefficient of 0.30. This implies that money demand will rise by 0.30 per cent if property wealth increases by 1 per cent.

The inclusion of property wealth is decisive for the stability of the model after 2002. If the model is estimated up to the 3rd quarter of 2013 without including property wealth, the estimate on the coefficient on domestic demand is considerably higher. Moreover, if property wealth is excluded, the alternative interest rate becomes insignificant. Both factors indicate that if property wealth is not included, the model is not well specified.

The model's explanatory power, measured as R^2, is 0.42. Consequently, it is unable to explain a substantial part of the variation in money demand. Most statistical assumptions are met, including the absence of autocorrelation and heteroskedasticity. However, there are problems with the normality assumption, which can be attributed to a few large residuals, cf. the chart below. This problem can be eliminated by including dummy variables for the quarters with the largest residuals. In general, the model estimate of the development in the money stock is lower than the actual development from 2004 to end-2007. Consequently, the rise in the money stock in that period cannot be explained by soaring house prices alone..

Fluctuations in the money stock, actual and estimated



Source: Danmarks Nationalbank and own calculations.

Demand for loans

With a view to focus on the description of the relationship between the demand for loans and the real economy, corporate lending is restricted to non-financial corporations. Borrowing decisions e.g. by insurance companies and other financial intermediaries may be based on financial considerations, which can lead to stronger fluctuations in lending to the financial sector, cf. e.g. ECB (2014).

Estimation of error correction model (1) leads to the following long-run relation for the demand for loans:

$$lending_t = \alpha + 0{,}33^{*}ytr_t - 1{,}33^{*}R_t^{lend} + 0{,}82^{***}we_t$$

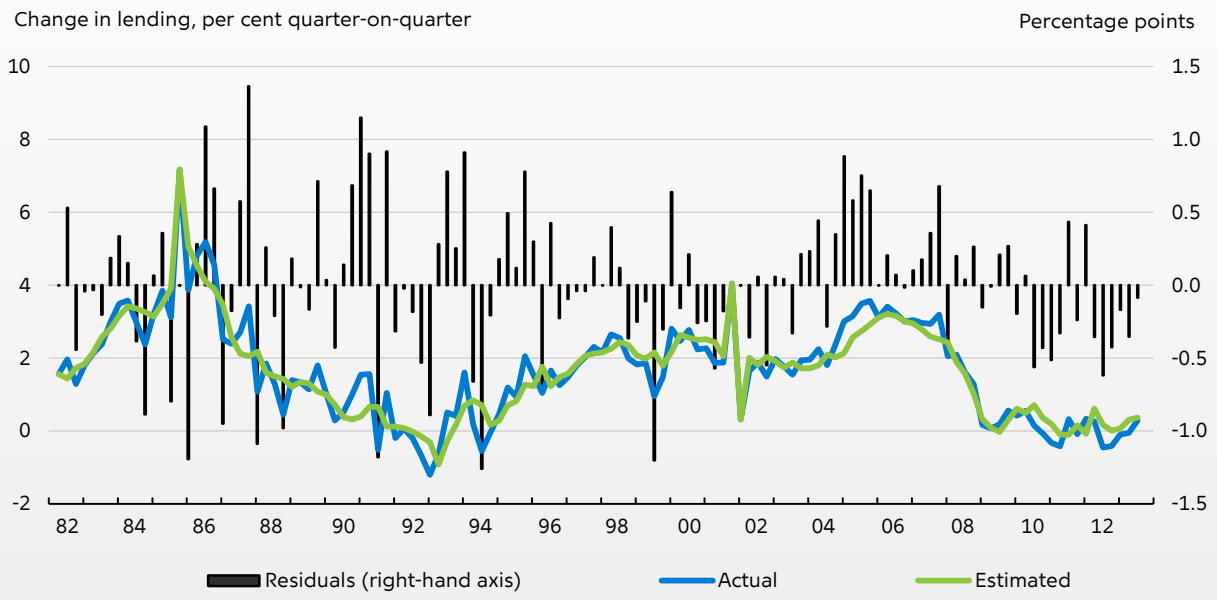
The coefficients on the variables have the expected signs. There are indications of error correction in the model, in that lending will tend to return to its long-run level after being hit by a shock. The results indicate that any deviation between actual lending and its long-run level narrows by approximately 6 per cent per quarter.

Both domestic demand and the lending rate are included in the long-run relation shown, but they are only significant at a level of 10 per cent. The two variables take explanatory power from each other. This reflects a positive trend in domestic demand and a negative trend in the lending rate over the estimation period. The coefficients on both demand and interest rate change, and their statistical significance grows, if one variable is included without the other. Statistically, there is no big difference between a model with either domestic demand or the lending rate and one with both variables.

The coefficient on domestic demand also depends on which measure of property wealth is included in the model. If only household property wealth is included, the explanatory power of domestic demand is weakened, and the positive residuals in 2005-07 tend to be smaller. The coefficient on property wealth is significant at a level of 1 per cent. All else equal, an increase in property wealth of 1 per cent increases lending by 0.8 per cent. The model shows signs of heteroskedasticity in the residuals. Apart from that, the model is generally well specified on the basis of standard misspecification tests. Dummy variables have been included in Q4 1985, Q4 2001 and Q1 2002 to ensure normal distribution of the residuals. Overall, the model captures lending fluctuations well, and its explanatory power measured as R^2 is 0.85. The residuals are predominantly positive in 2005-07. As is also the case for the money stock, the considerable growth in lending in the run-up to the financial crisis cannot be explained by soaring property prices alone. The residuals are predominantly negative after 2007. The development in credit since the financial crisis has thus been slightly weaker than predicted by the model.

Credit developments can also be influenced by supply factors. But empirical studies indicate that supply effects on lending in Denmark are limited, cf. Drejer et al. (2011), Abildgren and Kuchler (2013) and Abildgren (2013).

Fluctuations in lending by banks and mortgage banks, actual and estimated



Source: Danmarks Nationalbank and own calculations.

MARKET CONDITIONS IN THE BANKING SECTOR

Overall, banks determine interest rates and the other conditions for their deposits and loans with the aim of obtaining the highest possible return, while also considering the risk. Individual banks compete in the areas of lending and attracting deposits. A bank can increase its lending by reducing the lending rate. In order to fund the higher lending, the bank may have to raise its deposits rates, thereby eroding its earnings. At some stage a further increase in lending will not be profitable. In this way, competition for deposits and lending, combined with the banks' search for profit, serves to dampen growth in lending and the money stock.

The banks must continually consider the risks associated with their lending. The risk categories are liquidity risk and credit risk.

Liquidity risk reflects the banks' maturity transformation. While most deposits can be withdrawn or moved to another bank at short notice at the customer's request, loans usually have longer maturities. Access to stable funding is important to a bank. Funding sources include deposits from households and firms, including fixed term deposits. Such deposits cost more to attract than demand deposits, since the depositors demand compensation for binding their money for a certain period. Banks may also resort to the money and capital markets, but these funding sources are often regarded as less stable than deposits. This was evidenced during the financial crisis, when foreign banks extensively stopped lending to Danish banks, cf. Jørgensen et al. (2011).

Credit risk reflects the experience that some borrowers default on their loans. When a bank expands its lending, it may tend to attract riskier customers in the process. During the financial crisis, the banks that became subject to resolution were to a high degree those banks that had experienced strong lending growth in the preceding years. Both liquidity risk and credit risk thus have a dampening effect on lending and deposit growth in the financial sector.

When a bank considers return against risk, it does not necessarily take into account the social costs of its potential failure, such as financial instability and lower economic growth. Since the banks' liabilities do not extend beyond their equity capital, they may have an incentive to assume greater risks, e.g. on lending, than what is desirable for the economy overall. For this reason,

among others, the financial sector is subject to extensive regulation and supervision by the authorities.

Various countries have had requirements from time to time imposing on the banks to deposit a certain percentage of their deposits at the central bank. Denmark had such a reserve requirement for a short time in the mid-1980s aimed at limiting bank lending. This was a marginal reserve requirement entailing that some of the growth in deposits above a certain limit was to be placed as special deposits at Danmarks Nationalbank. Danmarks Nationalbank no longer uses reserve requirements. Instead, banks are now regulated via liquidity and capital requirements. In Denmark, the Danish Financial Supervisory Authority is tasked with ensuring that the banks comply with the requirements, which are very much the result of international legislation.

Other central banks have reserve requirements, e.g. the ECB and the Federal Reserve. The motivation for the Fed's reserve requirements has changed over time. Previously, reserve requirements were used to influence credit conditions and the money stock. This is no longer the case.

Today, the purpose of reserve requirements is typically to stabilise short-term money market interest rates. The reserve requirement is formulated as a requirement for the banks to have a certain average minimum deposit at the central bank over a given period. This deposit earns a higher interest rate than deposits at the central bank in excess of the reserve requirement. This gives the banks an incentive to lend liquidity in the money market when the short-term money market interest rate is high relative to the reserve requirement balance. Conversely, the banks have an incentive to hold ample reserves in periods of low money market interest rates. The reserve requirement thus contributes to smoothing fluctuations in short-term money market rates.

MONETARY POLICY

For most central banks, the money stock does not play a pivotal role in monetary policy. In an international context, the most widespread monetary policy objective is to keep inflation stable at a low level. Consequently, the decisive factor is not the amount of money in circulation, but stability in its purchasing power.

Danmarks Nationalbank has no objective for the growth rate in the money stock. In Denmark, monetary policy aims to keep the exchange rate of the krone stable against the euro. In view of the euro area's monetary policy objective of low and stable inflation, prices are also stable in Denmark, meaning that the money stock will develop in accordance with the overall monetary policy objective.

This does not mean that monetary policy is not important to the stock of money. Danmarks Nationalbank implements monetary policy by setting monetary policy rates, i.e. the interest rates on Danmarks Nationalbank's lending and deposit facilities.[16] They are key to money market interest rates, which are passed through to the banks' lending and deposit rates.[17] Interest rates have a direct impact on the demand for deposits and loans and hence also on the money stock and economic activity, which also influences the demand for deposits and loans.

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16 See Spange and Toftdahl (2014) for a review of Danmarks Nationalbank's implementation of monetary policy in Denmark.

17 See Drejer et al. (2011) for an analysis of the pass-through of monetary policy rates to retail rates.

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