Lower Turnover in the Danish Money Market

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INTRODUCTION AND SUMMARY

Activity in the money market has declined in 2013 relative to 2012, which is mainly attributable to lower turnover in uncollateralised money-market loans. This represents a continuation of the trend from the outbreak of the financial crisis in 2007-08, when focus on risks on uncollateralised interbank loans increased. A similar pattern has been observed internationally, e.g. in the euro area.

Especially the turnover in uncollateralised overnight loans has decreased. This should be viewed in the light of Danmarks Nationalbank's introduction of a negative rate of interest on certificates of deposit (CD rate) in July 2012 on account of the fixed-exchange-rate policy. The CD rate went from being higher than the current-account rate, to being lower, giving the banks (including mortgage banks) interest-rate incentive to increase their current-account deposits at Danmarks Nationalbank. At the same time, the credit institutions' access to place funds in current accounts was extended with the increase of the current-account limits. The higher current-account deposits have enhanced the credit institutions' scope for managing daily liquidity fluctuations without resorting to the money market.

Irrespective of the lower turnover in the money market, the monetary-policy transmission to the overnight interest rate remains intact. The higher current-account deposits have reduced the impact of changes in liquidity conditions on the interest-rate formation in the overnight market, compared with previously. The transmission to the overnight rate is illustrated in a simple econometric model.

The impact of monetary-policy instruments on the overnight rate is the first step in the interest-rate transmission. There has also been a clear pass-through from the negative CD rate to the slightly longer money-market rates, which determine the exchange rate of the krone. The krone has remained stable since the introduction of the negative CD rate in July 2012.

In the following, the development in money-market turnover is described, according to Danmarks Nationalbank's annual money-market survey. The interest-rate transmission from monetary-policy instruments to money-market interest rates is then analysed.

TURNOVER IN THE MONEY MARKET

In the 2nd quarter of 2013, daily turnover in money-market loans and interest-rate derivatives totalled kr. 126 billion[1], cf. Box 1, which contains a description of money-market products. Turnover in money-market loans in the Danish money market has generally declined relative to 2012. The market for uncollateralised deposits and loans accounts for the strongest drop in turnover. Turnover in interest-rate derivatives has increased, driven by higher turnover in CITA swaps.

Turnover in money-market loans

Turnover in uncollateralised deposits and lending has dropped by 40 per cent in 2013 relative to 2012, cf. Chart 1, left. This is mainly attributable to a decline in overnight loans, which nevertheless account for 77 per cent of total uncollateralised deposits and lending. The market for uncollateralised loans with longer maturities continues to be very limited, cf. Chart 2. Lending with maturities of more than one week show a daily average of kr. 15 million, or 0.2 per cent of total uncollateralised lending. This represents a continuation of the trend from the outbreak of the financial crisis in 2007-08, i.e. turnover in the uncollateralised money market has tended to decrease in Denmark, cf. Chart 1, right. The same development is seen in the euro area, cf. ECB (2013).

Part of the decline in uncollateralised overnight turnover reflects Danmarks Nationalbank's adjustment of the monetary-policy instruments in connection with the introduction of a negative CD rate in July 2012.

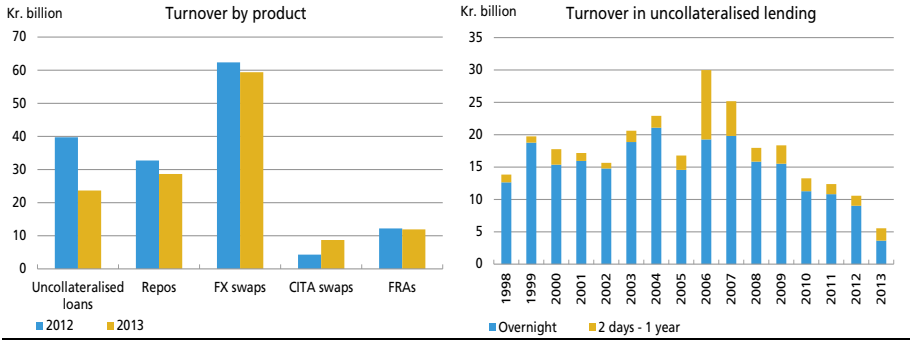
The CD rate went from being higher than the current-account rate, to being lower, giving the banks (including mortgage banks) an interest-rate incentive to place funds in current accounts, cf. Box 2, which contains a description of the monetary-policy instruments.[2] At the same time, the institutions' access to place funds in current accounts was extended with the increase of the current-account limits. The higher current-account deposits have enhanced the institutions' scope for managing daily liquidity fluctuations without resorting to the money market.

1 The reporting population of the 2013 money-market survey consists of nine reporting banks. This article also uses statistics from T/N reporting banks' daily reports concerning turnover in the overnight money market.

2 See Jørgensen and Risbjerg (2012) for a more detailed description of the introduction of a negative monetary-policy interest rate.

AVERAGE DAILY TURNOVER BROKEN DOWN BY PRODUCTS AND DEVELOPMENT IN UNCOLLATERALISED LOANS

Chart 1

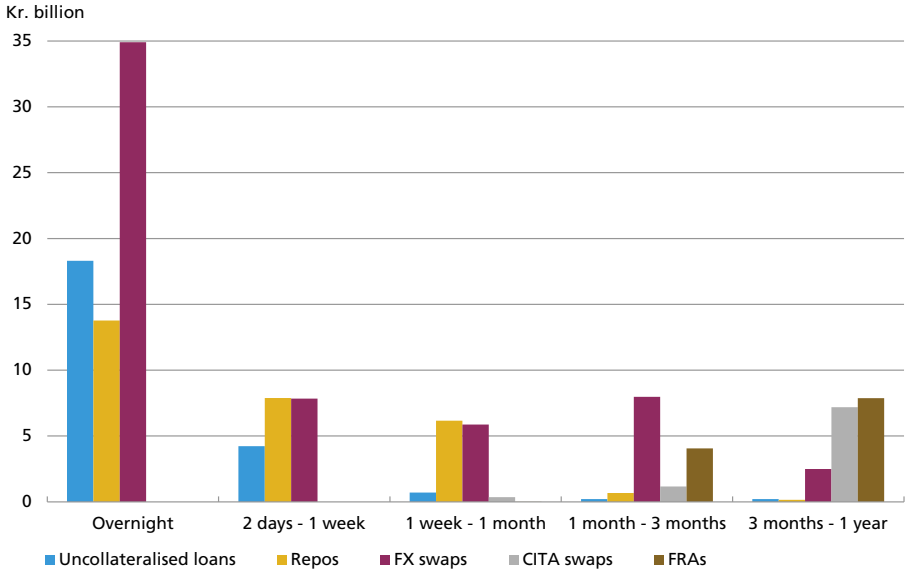


Note: Left-hand chart: Average daily turnover in the 2nd quarter of 2012 and 2013. Comprises deposits as well as lending for money-market loans. Right-hand chart: Average daily turnover in lending in April in the individual years. Turnover in total lending in 2008 and 2009 has been estimated on the basis of the T/N reporting banks' reporting as regards the overnight market and reporting of total turnover from a sample of T/N reporting banks.

Source: Danmarks Nationalbank.

AVERAGE DAILY TURNOVER IN MONEY-MARKET LOANS BROKEN DOWN BY MATURITIES AND PRODUCTS IN 2013

Chart 2



Note: Average daily turnover in the 2nd quarter of 2013. Comprises deposits as well as lending for money-market loans. The intervals cover the start of the interval and up to the end of the interval. For instance, 1 week – 1 month covers transactions with a maturity of more than 1 week up to and including 1 month.

Source: Danmarks Nationalbank.

PRODUCTS IN THE MONEY-MARKET SURVEY FOR DANISH KRONER Box 1

The money market for kroner is the interbank market up to and including 1 year for money-market loans and interest-rate derivatives.[1]

Money-market loans

Money-market loans are used to obtain or place liquidity and entail exchange of krone liquidity on the conclusion and expiry of the agreement.

Uncollateralised loans are loans in kroner without collateral with maturities from 1 day up to and including 12 months.

Repo transactions (repos or repurchase agreements) are collateralised loans in kroner with maturities ranging from 1 day up to and including 12 months. Repurchase agreements imply that on the conclusion of the agreement the seller of the bond (the recipient of the liquidity) undertakes to repurchase the securities at a future date at a price agreed on the conclusion of the agreement. The repo rate reflects the difference between the agreed purchase and sales prices.

FX swaps are collateralised loans in kroner with maturities from 1 day up to and including 12 months. In this case the collateral is provided in the form of foreign exchange. FX swaps can be seen as a simultaneous spot transaction and forward contract in foreign exchange. On the settlement of the spot transaction, for instance, kroner are exchanged for dollars while opposite payments are made on the settlement of the forward contract.

To this should be added krone-denominated bonds with a remaining maturity of up to and including 1 year, e.g. T-bills and mortgage bonds used to finance adjustable-rate loans. These are not comprised by the money-market survey.

Interest-rate derivatives

No initial exchange of liquidity takes place in connection with interest-rate derivatives. The exchange of liquidity is confined to the settlement of the interest-rate difference at a specified time in the future.

CITA swaps (Copenhagen Interest T/N Average) are short-term interest-rate swaps. A variable rate of interest (the T/N rate) is swapped for a fixed rate of interest determined at the start of the contract. On expiry of the agreement, the difference between the agreed fixed rate and the average T/N rate over the term of the agreement is settled. CITA swaps are used both for hedging interest-rate risks and for position-taking. Financial investors use CITA swaps, *inter alia*, to hedge the interest-rate risk of short-term securities such as 1-year mortgage bonds.

An *FRA (Forward Rate Agreement)* is an agreement to pay interest on a fictitious principal for an agreed future period at an agreed rate. At the beginning of the future period, an amount is settled equivalent to the difference between the agreed reference rate, e.g. CIBOR, and the agreed FRA rate on the principal. FRAs are typically entered for 3- and 6-month interest rates based on standardised contracts. If, in the future period, CIBOR exceeds the agreed FRA rate, the bank will receive an amount as compensation for the difference. However, if the interest rate is lower than the FRA rate, the bank must pay. FRAs are used both for hedging interest-rate risks and for position-taking.

[1] Cf. Mindested et al. (2012) and Danmarks Nationalbank (2009) for a more detailed description of the money market.

DANMARKS NATIONALBANK'S MONETARY-POLICY INSTRUMENTS Box 2

Monetary-policy instruments are the deposit and lending facilities made available by Danmarks Nationalbank for banks (including mortgage banks), the monetary-policy counterparties. The counterparties have access to two facilities at Danmarks Nationalbank: open-market operations and current-account deposits.

Through Danmarks Nationalbank's regular open market operations on the last banking day of each week, the counterparties can borrow against collateral and place the funds in certificates of deposits, CDs. If necessary, Danmarks Nationalbank also conducts extraordinary open market operations, in which it buys or sells CDs in order to manage the banking sector's liquidity.

Current accounts are demand accounts where the counterparties can place liquidity overnight. An overall limit has been determined for the counterparties' total current-account deposits with Danmarks Nationalbank at the close of the day. If the counterparties' current-account deposits exceed the overall limit, they will be converted into CDs.

[1] The monetary-policy instruments are described in more detail in Danmarks Nationalbank (2009).

Turnover in collateralised loans (repos and FX swaps) declined a little in 2013 relative to the 2012 survey.

FX swaps with one leg in kroner are primarily concluded with dollars as the other currency, cf. Chart 3, left. This reflects that the interbank market for FX swaps is generally dollar-based.[1] FX swaps between two currencies other than dollars are thus often executed via dollar swaps.[2]

In general, there is an overweight of foreign banks as counterparties in money-market transactions. This tendency is very clear for FX swaps, cf. Chart 3, right. One contributory factor is that foreign banks, in particular, have access to foreign exchange, e.g. dollars. The kroner that foreign banks receive via FX swaps can be placed, *inter alia*, in uncollateralised deposits in banks in Denmark. This is part of the explanation of foreign banks' large share of turnover in uncollateralised loans.

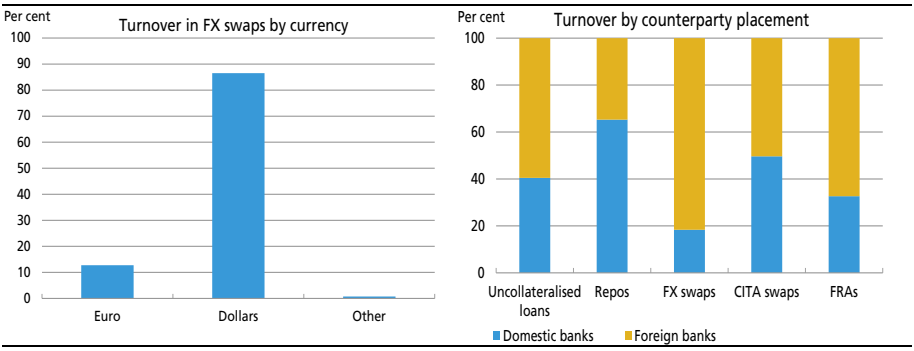
Turnover in the interest-rate derivatives market

The key interest-rate derivatives in the money market, CITA swaps and FRAs, are used by financial institutions, institutional investors and firms to hedge interest-rate risks and take positions. Maturities of more than 1 month account for the largest share of turnover, cf. Chart 2.

[1] For the first time since the annual money-market survey was introduced in 2010, it contains information on the currencies included in FX swaps with one leg in kroner. Every three years, the Bank for International Settlements, BIS, in collaboration with 53 central banks, conducts a survey of turnover in the global foreign-exchange and derivatives markets, i.e. the BIS Triennial Survey. The survey confirms that dollars were also previously included in most FX swaps. The volume of FX swaps with one leg in kroner is roughly the same in the BIS survey and the money-market survey.

[2] If, for instance, the objective is to receive pounds sterling, this can be achieved by first swapping Danish kroner for dollars and then swapping dollars for sterling. FX swaps are predominantly concluded with initial (spot) receipt of foreign exchange.

TURNOVER IN FX SWAPS BROKEN DOWN BY CURRENCIES AND TURNOVER BROKEN DOWN BY COUNTERPARTY PLACEMENT Chart 3



Note: Based on average daily turnover in the 2nd quarter of 2013. The survey concerns only transactions in which one of the currencies is Danish kroner.
Source: Danmarks Nationalbank.

FRA turnover is almost unchanged in 2013 relative to 2012, whereas turnover in CITA swaps has increased. According to market participants, one of the reasons is slightly higher uncertainty about the development in money-market rates in this period, compared with the very low level of uncertainty in 2012. Consequently, the incentive to hedge interest-rate risks and take positions has grown a little. Denmark's fixed-exchange-rate policy and a normally close relationship between interest rates in Denmark and the euro area have entailed that interest-rate risks are also to a considerable degree managed by means of the corresponding euro product, i.e. EONIA swaps.

INTEREST-RATE TRANSMISSION

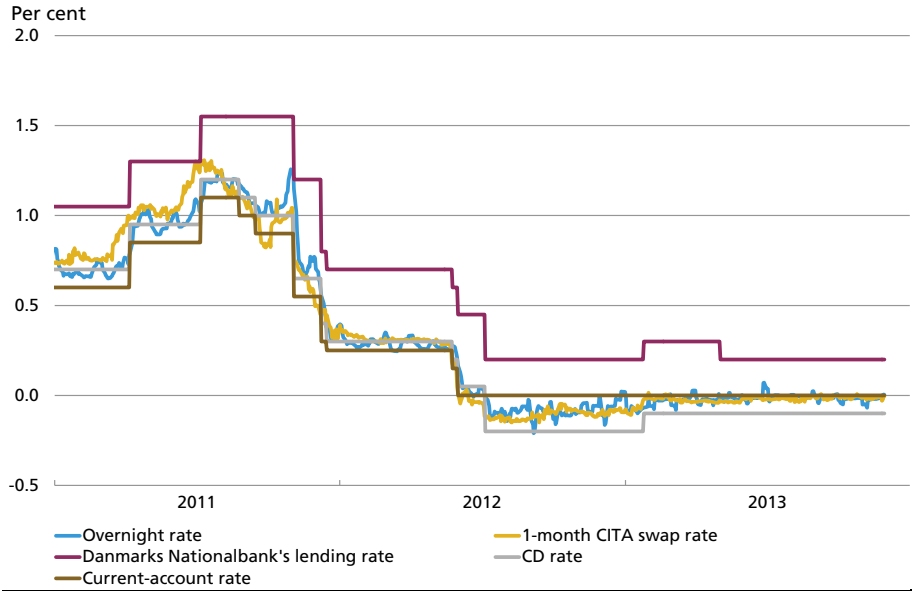
Irrespective of the lower turnover in the money market, the negative CD rate is clearly passed through to the short-term money-market rates, cf. Chart 4.

Interest-rate transmission in the overnight market

The transmission from monetary-policy rates to money-market rates is analysed further in a regression model.[1] The model explains the spread between the overnight rate and the current-account rate. The overnight rate in the model is the T/N rate, i.e. the reference rate for uncollateralised overnight loans.[2] The spread to the current-account rate has been chosen to avoid an artificially high explanatory power, which is

1 The model generally corresponds to the model in Andersen (2004).
2 T/N loans are overnight loans starting on the first banking day after the day of conclusion and expiring on the second banking day after the day of conclusion.

MONETARY-POLICY RATES AND MARKET RATES Chart 4



Note: Daily observations. The overnight interest rate is a 5-day moving average of the T/N rate.
Source: Reuters EcoWin and Danmarks Nationalbank.

solely a consequence of the general trend in overnight rate levels being determined by the current-account rate.

The spread between the T/N rate and the current-account rate is explained by the theoretical pass-through from monetary-policy rates (Interest-rate pass-through) and the spread between the CD rate and the current-account rate (Internal spread). The latter is included to describe the impact of the liquidity conditions in the money market. The possibility that the T/N rate may be affected by market perceptions of market risks (VIX) is also taken into account. The effect of the explanatory variables is permitted to be different before and after the introduction of a negative CD rate by using a dummy variable (D), assuming the value of 1 on days from the introduction of the negative CD rate, and zero before. The estimated model can be summarised in the following equation, which is estimated on daily data: [1]

[1] In order to take autocorrelation and heteoscedasticity into account in the residuals, Newey-West standard errors are used. The data period runs from 2 July 2007 to 30 August 2013. The estimation starts in the 2nd half of 2007, since the maturity of certificates of deposit was changed from 14 to 7 days in May 2007. The 14-day maturity meant that expectations of ECB interest-rate adjustments could have a strong effect on the T/N rate, cf. Danmarks Nationalbank (2007). (-1) denotes that the value from the previous day is included.

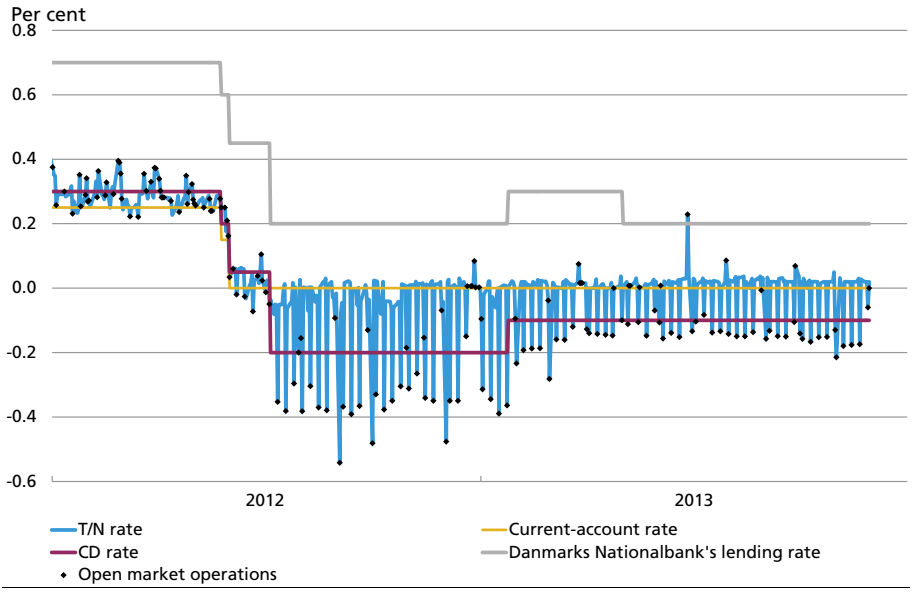
(1) T/N rate – current-account rate =
$\beta_0 + \beta_1$(Interest-rate pass-through) + β_2(Internal spread) + β_3VIX(-1) + $D\beta_{D,0}$ + $D\beta_{D,1}$(Interest-rate pass-through) + $D\beta_{D,2}$(Internal spread) + $D\beta_{D,3}$VIX(-1)

The explanatory variables and the results of the regression analysis are explained in more detail in the following.

Interest-rate pass-through

The T/N rate shows considerable day-to-day fluctuations, cf. Chart 5. Most of the fluctuations are technical and relate to the design of the monetary-policy instruments. The fluctuations arise in connection with Danmarks Nationalbank's open market operations, because the monetary-policy counterparties can thus place funds in certificates of deposit at a different interest rate and at longer maturities, compared to current-account deposits. The variable "Interest-rate pass-through" is included in order to examine whether the overnight rate is behaving according to the predictions made on the basis of monetary-policy interest rates. This relationship is described in more detail in Box 3.

MONETARY-POLICY RATES AND THE T/N RATE — Chart 5



Note: The T/N rate is affected on the day before the open market operation, since T/N loans are overnight loans that start on the day after conclusion. Hence, open market operations denote the T/N-rate value on the day before the open market operation.
Source: Danmarks Nationalbank.

TECHNICAL VOLATILITY IN THE OVERNIGHT RATE Box 3

It is possible to gain insight into the technical fluctuations in the overnight rate on the basis of the theoretical relation between the money-market rate and the monetary-policy rates. According to the relation, the overnight rate will, on days without open market operations, be equal to the current-account rate, which is the alternative rate of interest for overnight loans in the money market for the monetary-policy counterparties. On days with open market operations, the monetary-policy counterparties have access to buy (or sell) certificates of deposits (CDs), besides access to the current account. Accordingly, the CD rate is the alternative interest rate for the rate of interest on money-market placements until the next open market operation.[1] Counterparties with a liquidity surplus will assess the trade-off of the return on placing funds in CDs against current placement in the overnight money market until the next open market operation. As mentioned, the rate of interest on money-market placements corresponds to the current-account rate on the following days. When the CD rate is higher than the current-account rate, the overnight rate on the day of the open market operation should therefore be higher than the CD rate if the total return on placement in the money market is to be equal to placement in CDs.[2] In the current situation, with a negative CD rate lower than the current-account rate, the overnight rate on the day of the open market operation must be lower than the CD rate.[3]

The calculation of the theoretical overnight interest rate can be illustrated by an example involving a Friday when an ordinary open market operation is carried out. Assume that the next open market operation is 7 days away. The overnight rate on the Friday covers three days (Friday, Saturday and Sunday). On the following four days, the overnight rate is equal to the current-account rate. The counterparty's assessment of the trade-off between placement in certificates of deposit or in the money market can thus be written as:

(2) 3•Overnight rate + 4•Current-account rate = 7•CD rate

If the current-account rate is 0 per cent and the CD rate -0.10 per cent, the theoretical overnight rate on the basis of the above equation is -0.23 per cent. (= (7•(-0.10) – 4•0)/3 per cent). "Interest-rate pass-through" will have this value on the day of the open market operation and the value of zero on the other banking days when the theoretical overnight rate is equal to the current-account rate of 0 per cent.

Normally, the technical volatility in the overnight rate has no effect on the slightly longer money-market rates, which determine the exchange rate of the krone, cf. Andersen (2004).

[1] Besides buying and selling certificates of deposit, the counterparties in the ordinary open market operations may raise liquidity through loans from Danmarks Nationalbank. If the net position is positive, the CD rate tends to be key to the money-market rates. In June 2009, a spread was introduced between Danmarks Nationalbank's lending rate and the CD rate, which had been identical until then. The net position has been positive since the introduction of this spread.

[2] The effect on the overnight rate is stronger, the longer the time until the next announced open market operation, and the fewer the days until the next banking day, i.e. the fewer the days on which the overnight rate on the day of the market operation applies. If, for example, the open market operation falls on a Friday, the overnight rate on the day of the open market operation applies on three days (Friday, Saturday and Sunday), and the effect is distributed on the three days. The O/N rate is affected on the day of the open market operation, while the T/N rate is affected on the day before the open market operation, since the T/N rate is the rate of interest on an O/N loan starting on the following day.

[3] When counterparties' total placements in current accounts and certificates of deposit exceed the current-account limit, the counterparties can benefit from lending in the overnight market at a lower (more negative) interest rate than the CD rate, as the counterparties would thus avoid placing funds in certificates of deposit until the next open market operation.

ESTIMATION RESULTS FOR THE EFFECT ON THE SPREAD BETWEEN THE T/N RATE AND THE CURRENT-ACCOUNT RATE Table 1

	Before negative CD rate	After negative CD rate
Constant	-0.050*	0.010
	(0.030)	(0.021)
Interest-rate pass-through	0.545***	0.717***
	(0.025)	(0.017)
Internal spread	0.452***	0.363***
	(0.088)	(0.066)
VIX (-1)	0.003**	0.003**
	(0.001)	(0.002)
Adjusted R^2: 0.82		

Note: Based on daily data. *, **, *** denote levels of significance of 10, 5 and 1 per cent, respectively. Standard deviations are denoted in parenthesis. "Before negative CD rate" are coefficients on the explanatory variables. "After negative CD rate" shows estimates of the sum of the coefficients on the explanatory variables and the dummy variable*(explanatory variable). Standard errors and the level of significance have been found via a Wald test. The spread between the T/N rate and the current-account rate, "Interest-rate pass-through" and "Internal spread", are in percentage points.

The coefficient on "Interest-rate pass-through" is higher after the introduction of a negative CD rate, cf. Table 1. The increase is statistically significant. This means that the pass-through is intact. The coefficient after the introduction of a negative interest rate is 0.72, corresponding to an average increase by 0.72 percentage point in the T/N rate when "Interest-rate pass-through" indicates a 1-percentage-point increase. This reflects that the overnight rate is not only determined by "Interest-rate pass-through".

Internal spread

The interest-rate effect of monetary-policy rates is basically captured in "Interest-rate pass-through". "Internal spread" is included as an explanatory variable in order to describe the effect of liquidity conditions in the money market. Specifically, it captures the effect of a growing incentive – in step with widening of the spread – for monetary-policy counterparties to buy certificates of deposit rather than placing funds in current accounts. Hence the wider the spread, the smaller the balance on the current account, all else equal, which will have an upward effect on the spread between the overnight interest rate and the current-account rate, cf. Chart 6.[1] The coefficient on "Internal spread" before the

1 The monetary-policy counterparties do not have access to a standing lending facility at Danmarks Nationalbank for overnight borrowing. Thus, Danmarks Nationalbank's monetary-policy instruments do not put a cap on the overnight rate.

introduction of a negative CD rate is positive, as expected, and significant, cf. Table 1.[1]

After the introduction of a negative CD rate, which is, moreover, lower than the current-account rate, the counterparties have both an interest incentive and a liquidity incentive to place funds in current accounts rather than in certificates of deposit. At the same time, the current-account limits have been expanded. As a result, the monetary-policy counterparties have ample current-account deposits to cope with liquidity fluctuations, so there will be no low current-account balances which could push up the overnight rate, cf. Chart 6. The spread between the CD rate and the current-account rate now captures the conversion of counterparties' current-account deposits beyond their current-account limits into certificates of deposits if the total current-account balance exceeds the total current-account limits, cf. Box 2. If the counterparties find that the overall current-account limits are likely to be exceeded, they may be willing to lend at a lower interest rate than would otherwise be the case. The effect of "Internal spread" is positive, as expected, and still statistically significant, cf. Table 1. The coefficient is smaller after the introduction of a negative CD rate, but the change in the coefficient is not statistically significant. [2]

VIX

The overnight rate is also impacted by a number of other factors, including market perceptions of risk in the uncollateralised market, interest-rate expectations, etc.[3] The VIX index, which indicates the implied volatility of options on the US stock index S&P 500, has been included as an explanatory variable. The VIX index is often used as an indicator of financial turmoil and the general risk perception in the market. Higher uncertainty is expected to entail a higher T/N rate relative to the current-account rate, which gives a positive coefficient. The change in the coefficient at the introduction of a negative CD rate is not statistically significant.

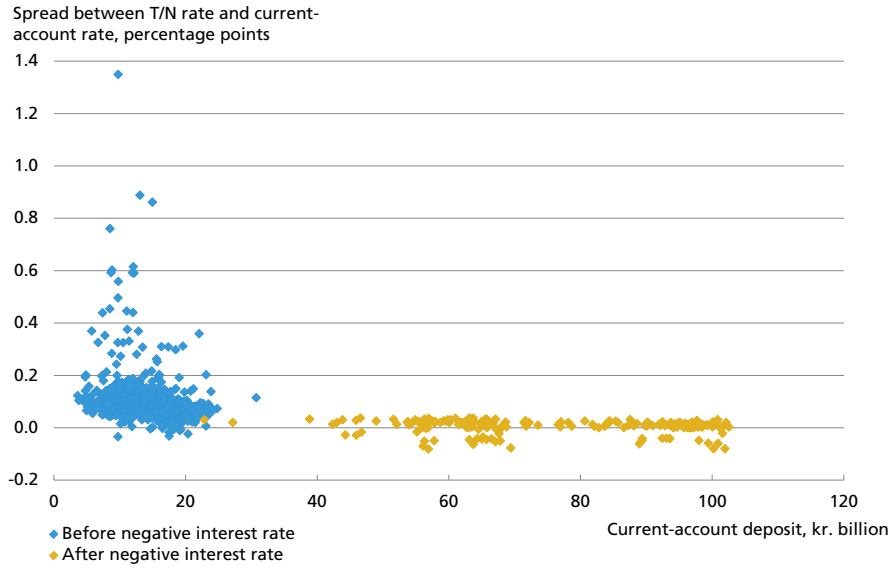
Overall, the model can explain most of the variation in the overnight interest rate both before and after the introduction of a negative CD

1 Regressions have been performed where the total current-account balance is included as explanatory variable (not shown). The related coefficient tends to become insignificant or have the opposite sign compared with what is expected in regressions that also include "Internal spread". In regressions including current-account balances as an explanatory variable instead of "Internal spread", the coefficient is negative, as expected, cf. Chart 6, and significant before the introduction of a negative CD rate.

2 If the current-account balance is included instead of "Internal spread" in the regression, the related coefficient is close to zero, as expected, cf. Chart 6, and insignificant after the introduction of a negative CD rate (not shown).

3 The credit risk on uncollateralised overnight loans points to a higher interest rate than the current-account rate. However, the credit risk is limited by the short maturity of the loans.

RELATION BETWEEN CURRENT-ACCOUNT DEPOSITS AND THE SPREAD BETWEEN THE T/N RATE AND THE CURRENT-ACCOUNT RATE — Chart 6



Note: Daily observations for the period 2 July 2007 – 30 August 2013. Observations from days when Danmarks Nationalbank does not carry out open market operations.
Source: Danmarks Nationalbank.

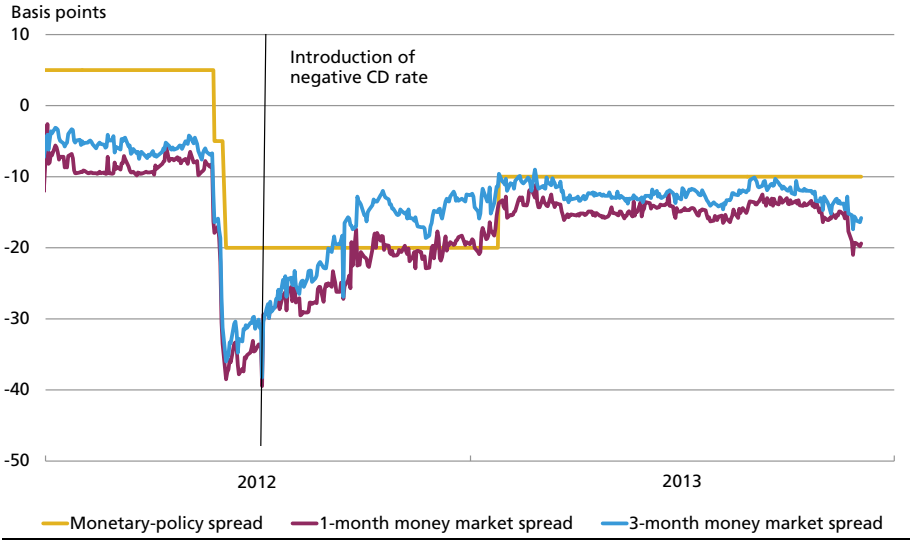
rate, and its explanatory power regarding the variation is at least as good after as before.[1] The effect of "Interest-rate pass-through" is increased by the introduction of a negative CD rate, supporting that the interest-rate pass-through is intact after the introduction of a negative CD rate.

Interest-rate transmission to longer money-market rates

The impact of monetary-policy instruments on the overnight rate is the first step in the interest-rate transmission to the longer money-market rates, in which expectations of future changes in monetary-policy rates play a key role. Likewise, a clear pass-through has been observed from the negative CD rate to the slightly longer money-market rate, e.g. the CITA rate, cf. Chart 4. The interest-rate spread to the euro area determines the exchange rate of the krone against the euro. The spread between the longer money-market rates in Denmark and the euro area has mirrored the development in the spread between Danmarks Nationalbank's and the ECB's monetary-policy rates, cf. Chart 7, and the krone has remained stable since July 2012.

1 As an alternative to a model with dummy variables, the model can be estimated on data before and after, respectively, the introduction of a negative CD rate. The explanatory power of the model (adjusted R^2) is highest when estimated on data after.

INTEREST-RATE SPREAD BETWEEEN DENMARK AND THE EURO AREA Chart 7



Note: The monetary-policy spread is the CD rate less the ECB's deposit rate. The money-market spread is the difference between the CITA rate and the EONIA swap rate.
Source: Danmarks Nationalbank and Reuters EcoWin.

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