

ECONOMIC COMMENTARIES

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NORGES BANK

What drives the risk premium in Nibor?

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1. Introduction

The risk premium in three-month Nibor has increased in the past couple of years, from around 25 basis points towards the end of 2014 to approximately 60 basis points in summer 2016. The increase in the premium (the difference between Nibor and the expected key policy rate) probably reflects a number of factors, including increased supply of liquidity in the euro area, banks' adjustment to new liquidity standards introduced under Basel III (LCR requirements) and the US money market reform. Understanding how these factors affect the Norwegian money market rate Nibor requires a closer look at how Nibor is constructed.

Nibor is quoted as a foreign exchange (FX) swap rate. This means that banks use a US dollar rate as a starting point and adjust this rate for the price of swapping USD into NOK in the FX swap market. Consequently, international conditions, such as a higher US dollar premium or a higher price to swap USD into NOK, can directly affect the premium in the Norwegian money market rate Nibor.

In this *Commentary*, we illustrate how the risk premium in Nibor can be decomposed to better understand the driving forces affecting the Norwegian money market rate. Furthermore, we use historical data to discuss how international conditions have influenced the risk premium in Nibor since the 2007-2008 financial crisis. The discussion in the main text is structured around the charts. A more precise mathematical decomposition of Nibor is shown in the appendix.

2. The Norwegian money market rate Nibor

Nibor (Norwegian Interbank Offered Rate) plays an important role as a reference rate for a wide range of loan contracts and for different types of derivatives. Nibor is intended to reflect the price of unsecured interbank loans in NOK and is quoted for maturities ranging from one week to one, two, three and six months. In this *Commentary*, we will primarily discuss three-month Nibor, which is the most important benchmark rate in the pricing of financial contracts and interest rate derivatives.

Like other countries' -ibor rates², Nibor can be decomposed into the expected key policy rate and a risk premium, given as

$$(1) i_N = OIS_N + rp_N$$

where i_N is Nibor, OIS_N is the "overnight index swap" (OIS) rate in Norway and rp_N is the risk premium in Nibor³. An OIS rate expresses the average expected

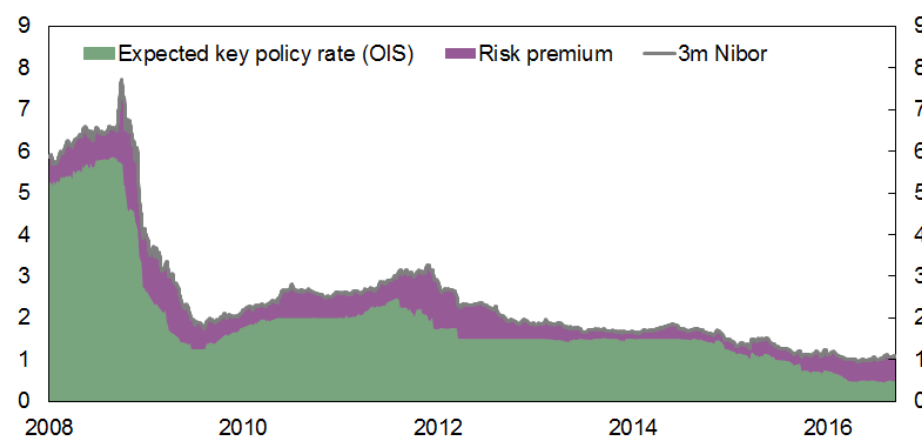
¹ The authors are all on the staff of the Market Operations and Analysis Unit of Norges Bank. The views expressed are those of the authors and do not necessarily reflect those of Norges Bank. We are grateful to Tom Bernhardsen, Arne Kloster and Olav Syrstad for their valuable comments.

² The term "-ibor rates" refers to the benchmark rates Libor, Euribor, Stibor, Cibor etc.

³ An OIS is an interest rate swap between two parties, one of which pays the fixed OIS rate for a specific period, while the other pays the floating short rate on which the OIS rate is based. This is usually an overnight rate.

overnight rate for a given period. Since the overnight rate is normally close to the key policy rate, the OIS rate can be regarded as an estimate of the average expected key policy rate. As Norway, unlike many other countries, does not have an OIS market, decomposing Nibor into the expected key policy rate and a risk premium is not straightforward. Norges Bank, however, makes daily estimates of the risk premium in three-month Nibor based on judgement and cross-check calculations. Chart 1 shows developments in the estimated decomposition of three-month Nibor into the expected key policy rate three months ahead (OIS) and a risk premium. The risk premium varies over time and was particularly high during the 2008-2009 financial crisis and during the crisis in the European government bond market in 2011-2012. Since the end of 2014, the premium has again increased somewhat, from around 25 basis points to around 60 basis points.

Chart 1: Decomposition of three-month Nibor into expected key policy rate (OIS) and risk premium. Five-day moving average. Percentage points. 5 January 2008 – 15 September 2016



Sources: Bloomberg and Norges Bank

Nibor differs from similar rates in many other countries in that it is constructed as an FX swap rate.⁴ The Nibor panel banks base their Nibor quotes on a US dollar rate that reflects the cost of borrowing USD in the unsecured interbank market. The banks then adjust this rate for the price of swapping USD for NOK in the FX swap market, given by the differential between the USD/NOK forward and spot exchange rates (forward points). Nibor thereby becomes a NOK interest rate, reflecting the price of unsecured interbank loans in NOK. Nibor can thus be written as

$$(2) \quad i_N = i_{\$,N} + (f_{\$,N} - e_{\$,N})$$

where i_N is three-month Nibor, $i_{\$,N}$ is the US dollar rate used by Nibor panel banks as a basis for their quotes, $f_{\$,N}$ is the forward exchange rate and $e_{\$,N}$ is

⁴ An FX swap between two banks can be regarded as a secured interbank loan. The difference between a swap and a repo is that the lender receives collateral in the form of another currency rather than in the form of securities. The parties to an FX swap exchange currencies at the current FX market spot rate and agree to reverse the swap on an agreed date in the future at a rate agreed on today. This future rate is called the forward rate. The difference between the spot rate and the forward rate, known as the forward premium or forward points, expresses the interest rate differential between the two currencies over the life of the swap.

the spot exchange rate (NOK per 1 USD, where an increase implies a weaker krone, both in logarithmic form).^{5,6}

3. Decomposition of Nibor

As illustrated in equation (2), Nibor can be decomposed into a US dollar rate and the interest rate differential between USD and NOK in the FX swap market. In the coming we will take a closer look at the factors influencing the US dollar rate used by Nibor panel banks as a basis for their quotes and the relative liquidity premiums between USD and NOK in the FX swap market.

Relative liquidity premiums in the FX swap market

According to the theory of covered interest parity, there should be no opportunity for arbitrage when borrowing in one currency and investing in another once the foreign currency risk is hedged through an FX swap. The FX forward points compensate for the differential between expected policy rates in the two currencies. If the interest rate differential in the FX swap market deviates from the differential between expected policy rates, the deviation can be interpreted as relative liquidity premiums between two currencies.⁷ This is expressed in the FX swap market when the cost of exchanging one currency for another is higher than would be implied by the differential between the expected policy rates.

The relative liquidity premium between two currencies can be measured as the difference between the interest rate differential as measured by OIS rates and the interest rate differential in the FX swap market. Such deviations can arise as a result of differences in access to funding (liquidity premiums) between two currencies. These deviations are referred to as the OIS basis between two currencies and typically arise when demand for or the supply of the one currency is particularly high relative to the other currency. The USD/NOK OIS basis can be written as:

$$(3) \text{OISB}_{\$,N} = (f_{\$,N} - e_{\$,N}) - (\text{OIS}_N - \text{OIS}_{\$})$$

where $\text{OISB}_{\$,N}$ is the OIS basis between USD and NOK, OIS_N is the OIS rate for NOK and $\text{OIS}_{\$}$ is the OIS rate for USD, and where $f_{\$,N}$ is the USD/NOK forward exchange rate and $e_{\$,N}$ is the USD/NOK spot exchange rate.⁸ The FX forward points, expressed by the term $(f_{\$,N} - e_{\$,N})$, compensate for the interest rate differential between the two currencies. If the OIS basis is not zero, the

⁵ The current Nibor panel banks are DNB Bank ASA, Danske Bank, Handelsbanken, Nordea Bank Norge ASA, SEB AS and Swedbank. In the Nibor fixing conducted every business day at noon, the highest and lowest quotes are discarded and Nibor is calculated as the average of the remaining quotes. The Nibor rules are currently set by Finance Norway (see <https://www.finansnorge.no/en/interest-rates/nibor---the-norwegian-interbank-offered-rate/>). The calculation agent is the Oslo stock exchange, Oslo Børs.

⁶ Norges Bank has been critical of the construction of Nibor as an FX swap rate, as expressed in Norges Bank's letter with attachments of 26 May 2014 to Finanstilsynet (see <http://www.norges-bank.no/en/Published/Submissions/2014/Letter-2-June-2014/>).

⁷ For a more detailed description of why this deviation can be interpreted as relative liquidity premiums between two currencies, see Syrstad O. (2014): "The Impact of the Term Auction Facility on the Liquidity Risk Premium and unsecured Interbank Spreads", Norges Bank Working Papers 7/2014.

⁸ Equation (3) is derived based on covered interest parity for OIS rates, cf equation (5) in the appendix.

forward points not only compensate for the differential between expected policy rates, but also include a relative liquidity premium.⁹

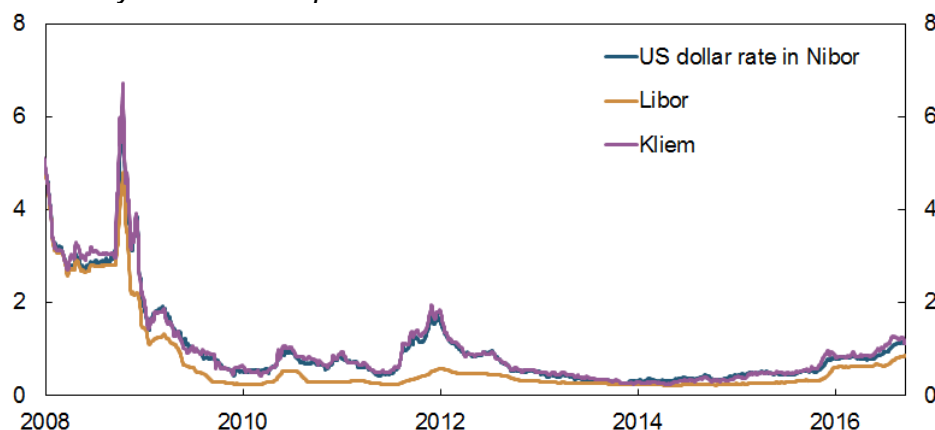
Equation (1) shows how Nibor can be decomposed into the expected policy rate (OIS_N) and a risk premium (rp_N). In the appendix, we show how the risk premium in Nibor can be further decomposed into the risk premium in the US dollar rate used by Nibor panel banks as a basis for their quotes ($rp_{\$,N}$) and the USD/NOK OIS basis ($OISB_{\$,N}$)¹⁰. Nibor can then be written as

$$(4) i_N = OIS_N + rp_{\$,N} + OISB_{\$,N}$$

The US dollar rate in Nibor

To continue our decomposition of Nibor, we examine different factors affecting the US dollar rate used by Nibor panel banks as a basis for their quotes. As mentioned in the introduction, the Nibor panel banks base their quotes on a US dollar rate that reflects the price of unsecured interbank loans in USD. Before the financial crisis, the banks used the US dollar Libor rate as a basis for their Nibor quotes. During the financial crisis, it was widely claimed that Libor underestimated the actual US dollar rate facing banks in the interbank market, and Nibor panel banks decided to switch to a US dollar rate published by the brokerage house Carl Kliem in Frankfurt as the basis for Nibor. The Kliem rate is considered to express the cost to euro area banks of borrowing USD in the unsecured interbank market. Kliem is also constructed as an FX swap rate as it is implied by the cost of borrowing EUR (at the euro area money market rate Euribor) and swapping into USD in the FX swap market. The Kliem rate can thus be regarded as an expression of the price of borrowing USD via EUR. Chart 2 shows three-month Libor and Kliem rates and the implied US dollar rate used by Nibor panel banks as a basis for their quotes.¹¹

Chart 2: Three-month US dollar rates. Five-day moving average. Percent. 5 January 2008 – 15 September 2016



Sources: Bloomberg and Norges Bank

⁹ If there is a shortage of USD, banks will seek to obtain USD in the FX swap market, buying USD spot and selling USD forward, increasing the demand for NOK at the forward rate and thereby strengthening the NOK forward rate ($\Delta f_{N,\$} < 0$). The forward points and the OIS basis fall (and may become negative).

¹⁰ See equation (6) in the appendix.

¹¹ The US dollar rate applied by the Nibor panel banks is calculated based on equation (1). The Nibor quotes and forward points are observed in the market, and the US dollar rate is automatically given by the equation.

The US dollar rate in Nibor moved closely in tandem with Libor up to the onset of the financial crisis in 2008. Since, then, the US dollar rate has moved more in line with the Kliem rate, which has been somewhat higher than Libor. Even though the Nibor panel banks base their quotes on the Kliem rate, they are at liberty to adjust this US dollar rate to reflect the perceived interest rates facing them in the unsecured US dollar market as closely as possible. Borrowing directly in the US commercial paper (CP) market also provides an expression of the price of an unsecured US dollar loan. Several Nibor panel banks obtain short-term US dollar funding in this market. As a result, the US dollar rate used by Nibor panel banks as a basis for their quotes may be influenced by the price of issuing commercial paper in the US CP market.¹² With this type of adjustment based on judgement, the Nibor panel banks can base their quotes on different US dollar rates, and the implied US dollar rate in Nibor can deviate somewhat from the Kliem rate.

4. Decomposition of the premium in Nibor

The risk premium in Nibor is determined by the risk premium in the US dollar rate used by Nibor panel banks as a basis for their quotes ($rp_{\$,N}$) and the USD/NOK OIS basis:

$$(5) \quad rp_N = rp_{\$,N} + OISB_{\$,N}$$

If, for the sake of simplicity, we assume that the Nibor panel banks base their quotes on the Kliem rate, the risk premium in Nibor can be decomposed further.

The Kliem rate is in practice the euro area money market rate Euribor swapped into USD. Thus, the risk premium in the Kliem rate can be expressed as the sum of the risk premium in the Euribor rate and any liquidity premiums in the FX swap market between EUR and USD.¹³ Thus, Nibor and the risk premium in Nibor must be understood in the light of Euribor and relative liquidity premiums between EUR and USD and between USD and NOK.

Taking this as our starting point, we show in the appendix that the risk premium in Nibor can be written as

$$(6) \quad rp_N = rp_{\epsilon} + OISB_{\epsilon,\$} + OISB_{\$,N}$$

where rp_{ϵ} is the risk premium in the Euribor rate and $OISB_{\epsilon,\$}$ is the OIS basis between EUR and USD given by

$$(7) \quad OISB_{\epsilon,\$} = (f_{\epsilon,\$} - e_{\epsilon,\$}) - (OIS_{\$} - OIS_{\epsilon})$$

where $f_{\epsilon,\$}$ is the forward exchange rate and $e_{\epsilon,\$}$ the spot rate between EUR and USD (number of USD per 1 EUR, where a rise implies a weaker dollar, both in logarithmic form).

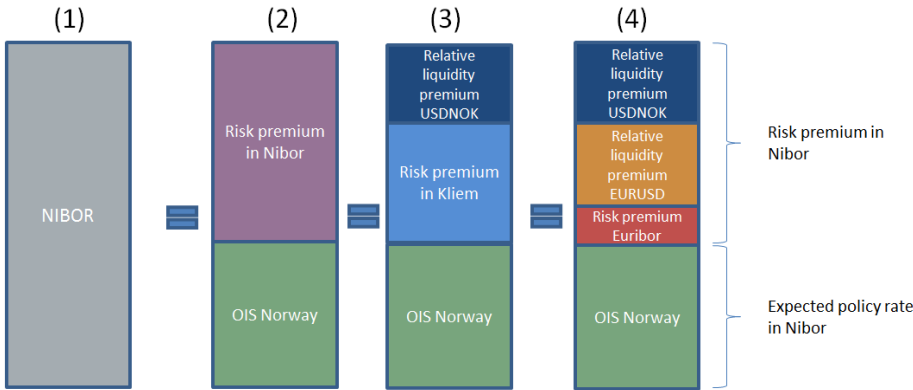
Chart 3 illustrates the different ways in which Nibor can be decomposed. Column 2 shows that Nibor can be decomposed into the expected policy rate

¹² The CP rate is not an interbank interest rate. At the same time, this rate expresses the cost of borrowing and not lending, as is the case for the Nibor rate. Owing to these two factors, the CP rate will be lower than the US dollar rate used by Nibor panel banks as a basis for their quotes, cf Chart 6 below.

¹³ See equations (7) to (11) in the appendix for a detailed description of the decomposition of the premium in the Kliem rate.

and a risk premium. Column 3 shows that the premium in Nibor can in turn be decomposed into the risk premium in the Kliem rate and the relative liquidity premium between USD and NOK (the OIS basis between USD and NOK). If there is no liquidity premium between USD and NOK, the premium in Nibor will be equal to the premium in the Kliem rate.¹⁴ Column 4 shows that the premium in the Kliem rate can in turn be written as the premium in the Euribor rate plus any liquidity premium between EUR and USD. If the liquidity premium between EUR and USD is zero, the premium in the Kliem rate will be equal to the premium in Euribor. In other words, if there are no liquidity premiums in the market, between EUR and USD or between USD and NOK, the premium in Nibor will be equal to the premium in Euribor.

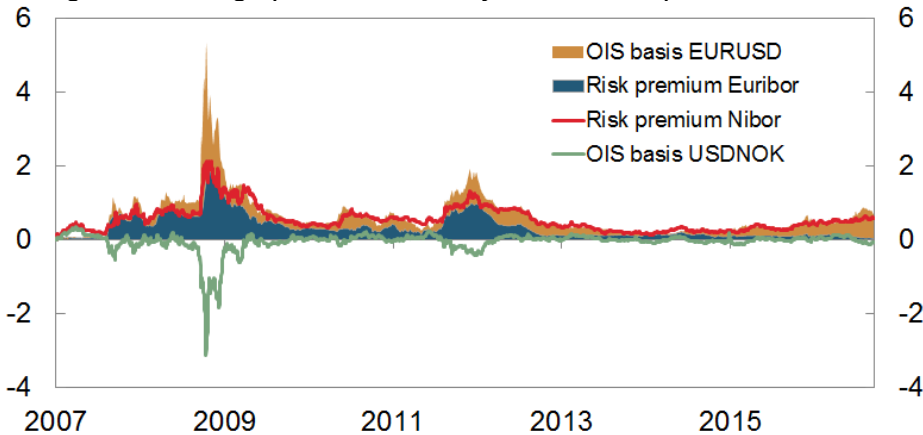
Chart 3: Decomposition of Nibor



5. What has driven the risk premium in Nibor?

Based on the decomposition of Nibor discussed above, we can use historical data to describe how various driving forces have affected the risk premium in Nibor since the financial crisis. Chart 4 shows the decomposition of the risk premium in Nibor going back to 2007.

Chart 4: Decomposition of the risk premium in Nibor. Five-day moving average. Percentage points. 5 January 2007- 15 September 2016



Sources: Bloomberg and Norges Bank

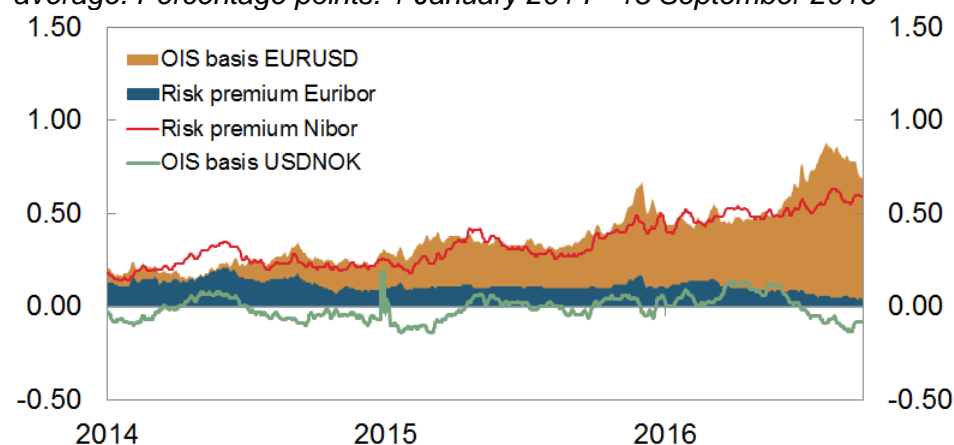
¹⁴ Nibor cannot be mechanically equated with the Kliem rate swapped into NOK as the US dollar rate used by Nibor panel banks as a basis for their quotes can deviate from the Kliem rate, cf the discussion above and Chart 2. For illustrative purposes, however, we have assumed in Chart 3 that the Kliem rate provides a good approximation of the US dollar rate used by Nibor panel banks as a basis for their quotes.

During the **financial crisis of 2008-2009**, the risk premium in Nibor was (estimated to be) over 200 basis points, driven to a great extent by a large risk premium in Euribor (blue area). There was also a substantial liquidity premium on USD relative to EUR, given by the EUR/USD OIS basis (yellow area). A higher premium in Euribor and an increase in the cost of swapping EUR for USD contribute in isolation to a higher risk premium in Nibor via a higher risk premium in the Kliem rate. However, higher demand for USD made it cheaper to exchange USD for NOK. The USD/NOK OIS basis fell and became negative (green line), thereby dampening the contagion effect on the risk premium in Nibor.^{15,16}

The **crisis in the European government bond market in 2011-2012** showed a similar trend, although the effects were somewhat less pronounced. Demand for USD increased and the OIS basis between EUR and USD rose (yellow area), probably reflecting not only market participants' desire to retain USD but also a reluctance to be left holding EUR, given the heightened uncertainty regarding the future of the euro area. Some of the increase in the premium in the Kliem rate was again offset by a negative OIS basis between USD and NOK (green line). This limited the contagion effect on Nibor of the high premium in the Kliem rate.

Since the beginning of 2015, a marked liquidity premium has again arisen between EUR and USD, although it has not been offset to the same extent this time by an OIS basis between USD and NOK with the opposite sign (Chart 5).

Chart 5: *Decomposition of the risk premium in Nibor. Five-day moving average. Percentage points. 1 January 2014 - 15 September 2016*



Sources: Bloomberg and Norges Bank

One possible interpretation of these developments is that the OIS basis between EUR and USD has been driven to a greater extent by a “surplus supply” of EUR as a result of the liquidity provided by the European Central Bank (ECB) through its asset purchase programme. The ECB announced its

¹⁵ Note that with a liquidity premium on USD, the OIS basis between NOK and USD falls, while the OIS basis between USD and EUR rises. This is because we have defined the exchange rate between NOK and USD as the number of NOK per 1 USD (a rise in the rate implies a weaker krone and a stronger dollar), while the exchange rate between EUR and USD is defined as the number of USD per 1 EUR (a rise in the rate implies a weaker dollar and a stronger euro).

¹⁶ This is discussed in more detail in Bernhardsen, T., A. Kloster and O. Syrstad (2012): “Risk premiums in NIBOR and other countries’ interbank lending rates”, Norges Bank Staff Memo 21/2012.

programme for the purchase of securities in the secondary market in January 2015 (also known as quantitative easing or QE). The programme has since been expanded from EUR 60 billion to EUR 80 billion a month. The ECB's injection of euro liquidity has lowered the cost of borrowing in EUR, even for market participants originally seeking funding in other currencies. These participants will typically use FX swaps, such as cross-currency swaps, to swap EUR for the currency they need. When many international market participants do this at the same time, the supply of EUR in the FX swap market will increase. This may give rise to liquidity premiums in cross-currency swaps where one of the currencies is EUR and the other is, for example, USD. This is illustrated in Chart 5 by a higher OIS basis between EUR and USD, which in isolation results in a higher risk premium in the Klieim rate.

As the ECB's measures do not affect the liquidity situation between USD and NOK, nor do they affect the liquidity premium between these two currencies to any great extent. As a result, a positive OIS basis between EUR and USD will not be cancelled out by a negative OIS basis between USD and NOK, as observed during the financial crisis and the crisis in the European government bond market. Thus, the net effect pulls in the direction of a higher risk premium in the Klieim rate, which will to a greater extent pass through to Nibor, resulting in a higher risk premium in Norway.

Another reason for the increase in the Nibor spread is probably related to regulatory conditions. The global financial crisis revealed a number of weaknesses in the financial system. Banks' capital levels were too low relative to the risk they took on, and liquid assets and stable funding were inadequate. One response to this has been an increase in financial market regulation.

Several of the Nibor panel banks obtain short-term USD funding in the US money market. As US money market funds are an important investor in this market, new rules for US money market funds have probably had an effect on funding costs for the Nibor panel banks and resulted in a higher risk premium in Nibor.

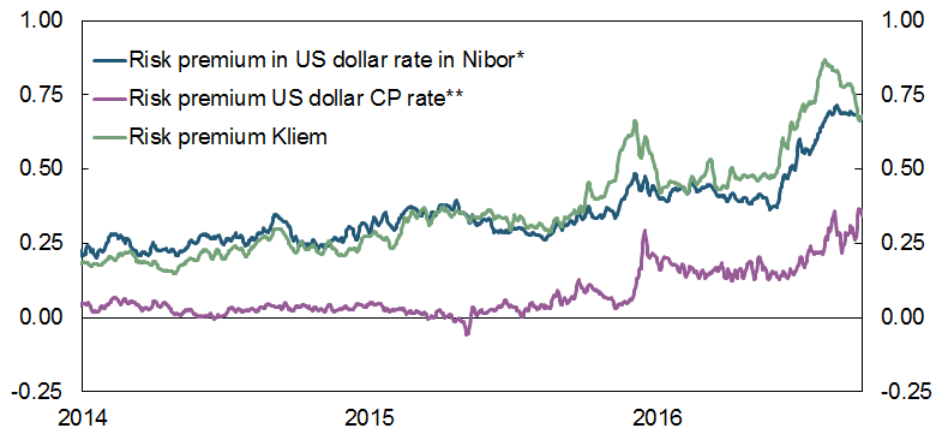
The US money market reform that was announced in mid-2014 will enter into force in mid-October this year and apply primarily to prime funds, which invest in instruments such as commercial paper issued by banks. Under the new rules, a number of these funds must sell and redeem shares at market price rather than at the previous fixed share price. In addition, the rules allow the funds to restrict redemptions, either directly or by imposing fees, if the level of liquidity falls below a certain level.

The money market reform has led a number of investors in prime funds to withdraw their capital before the new reform becomes effective. Furthermore, a number of fund providers have converted existing prime funds into government money market funds¹⁷, which are not subject to the same rules. At the same time, maturities on prime fund investments have fallen considerably in order to prepare for any further withdrawals of capital. The availability of bank funding in the US money market has thereby diminished, particularly at longer maturities. Chart 6 illustrates the increase in the cost of issuing commercial paper by banks in the US market. The chart shows that higher

¹⁷ Government money market funds invest in government or government-backed assets, while prime funds have a broader investment universe, investing primarily in securities issued by non-financial enterprises and banks.

USD funding costs for banks has also had an impact on the Kliem rate, which reflects the price of borrowing USD via EUR. This has in turn led to a higher premium in the implied US dollar rate in Nibor.

Chart 6: Risk premiums in three-month US dollar rates. Five-day moving average. Percentage points. 1 January 2014 – 15 September 2016



* The US dollar rate is calculated based on the Nibor rate fixed daily and three-month forward points between USD and NOK

** AA Financial Commercial Paper Interest Rate

Sources: Federal Reserve, Bloomberg and Norges Bank

Another response to the financial crisis is the new regulatory framework for the banking sector (Basel III). An important component of Basel III is the Liquidity Coverage Ratio requirement for banks (LCR).¹⁸ The objective of the requirement is to ensure that banks hold sufficient liquid reserves to survive a period of financial market stress. Banks are required to be able to cover total net cash outflows over a stress period of 30 days. When a bank issues commercial paper or obtains unsecured funding of some other kind with a maturity of less than 30 days, this will be included as an expected outflow in the LCR denominator. The LCR thus provides incentives for banks to seek longer-term funding. Bank's demand for unsecured funding with a maturity of more than 30 days will then increase relative to short-term funding (less than 30 days). As a result, risk premiums can be expected to rise for maturities of more than 30 days and fall for shorter maturities.

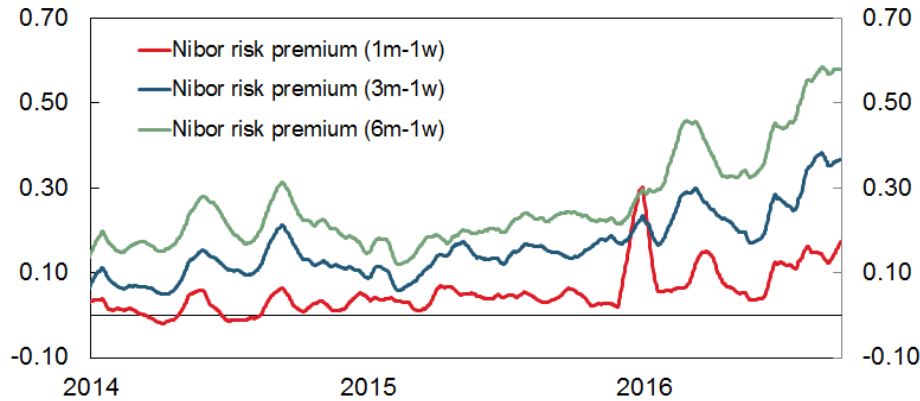
The LCR and the US money market reform leave issuers and investors with differing preferences with regard to maturity. While banks prefer to obtain longer-term funding, money market funds prefer shorter terms on their investments (in commercial paper, for example). Both the LCR and the US money market reform have contributed to increasing the risk premium in Nibor, and the effect seems to have been most pronounced on longer-term money market rates, resulting in a steeper Nibor curve. As the LCR has been phased in gradually and money market funds have had more than two years to adjust to the new rules, the steepening of the curve has also taken place over time.¹⁹

¹⁸ LCR is an abbreviation for liquidity coverage ratio. The LCR has two components: a) value of the stock of unencumbered high-quality liquid assets in stressed conditions b) total net cash outflows in the stress period (expected outflows minus expected inflows, based on the assumption that wholesale funding cannot be rolled over and that the bank loses a proportion of its deposits). The ratio of component a) to component b) is required to be higher than or equal to 100 percent. See Norges Bank's *Financial Stability Report 2015*, pp. 34-35 for a detailed description of the new liquidity rules for Norwegian banks.

¹⁹ Systemically important banks were required to meet the LCR standard in full as from 31 December 2015, while other banks and mortgage companies can phase in the LCR standard over a transitional period from

Chart 7 shows the Nibor curve for maturities of one week and one, three and six months. As illustrated in the chart, while the premium in three-month Nibor was about 10 basis points higher than the premium in one-week Nibor at the beginning of 2014, it is now almost 40 basis points higher.

Chart 7: Steepening of the money market curve in Norway. 20-day moving average. Percentage points. 1 January 2014 – 15 September 2016



Sources: Bloomberg and Norges Bank

Summary

Nibor is constructed as a foreign exchange (FX) swap rate. This means that banks use a US dollar rate as a starting point and adjust this rate for the price of swapping USD into NOK in the FX swap market. Nibor can thus be directly affected by external conditions, either through the US dollar rate used by Nibor panel banks as a basis for their quotes or via the price of swapping USD into NOK in the FX swap market.

The decomposition of the risk premium in Nibor in this *Commentary* indicates that the increase in the premium in recent years has to a great extent been driven by an increase in the liquidity premium on USD relative to EUR. The relative shortage of USD is partly the result of a surplus supply of EUR after the implementation of quantitative easing by the ECB and partly the result of regulatory conditions in the form of new rules for US money market funds. Together, these factors have led to an increase in the premium in the US dollar rate used by Nibor panel banks as a basis for their quotes. Stricter liquidity requirements for banks have probably also contributed to higher money market premiums and amplified the effect of the US money market reform.

31 December 2015 to 31 December 2017. In its consultation document to the Ministry of Finance of 1 September, Finanstilsynet (Financial Supervisory Authority of Norway) recommended that for enterprises with EUR and/or USD as significant currencies, an LCR requirement in NOK of at least 50 percent should be introduced.

Appendix: A mathematical decomposition of Nibor and the risk premium in Nibor

In practice, Nibor is constructed as an FX swap rate and can be expressed as

$$(1) i_N = i_{\$,N} + (f_{\$,N} - e_{\$,N})$$

where i_N is Nibor, $i_{\$,N}$ is the US dollar rate used by Nibor panel banks as a basis for their Nibor quotes, $f_{\$,N}$ is the forward exchange rate and $e_{\$,N}$ is the spot exchange rate (NOK per 1 USD, where an increase implies a weaker krone, both in logarithmic form).

Money market rates can be decomposed into expected policy rates and risk premiums, with Nibor and the US dollar rate in Nibor written, respectively, as

$$(2) i_N = OIS_N + rp_N$$

$$(3) i_{\$,N} = OIS_{\$} + rp_{\$,N}$$

where $i_{\$,N}$ is the US dollar rate in Nibor, $OIS_{\$}$ is the OIS rate for USD, OIS_N is the OIS rate for NOK, $rp_{\$,N}$ is the premium in the US dollar rate in Nibor and rp_N is the risk premium in Nibor.²⁰

If we insert (2) and (3) into (1) and solve the equation to arrive at the risk premium in Nibor, this can be expressed as

$$(4) rp_N = rp_{\$,N} + (f_{\$,N} - e_{\$,N}) - (OIS_N - OIS_{\$})$$

The last two terms in equation (4) are referred to as the OIS basis between NOK and USD, given by

$$(5) OISB_{\$,N} = (f_{\$,N} - e_{\$,N}) - (OIS_N - OIS_{\$})$$

If covered interest parity holds between the OIS rates, the difference between the OIS rates will be equal to the forward points and the OIS basis will be equal to zero. Deviations from covered interest parity, and thereby a non-zero OIS basis, can arise if demand for or the supply of one currency is higher than for another currency. Such a deviation can be interpreted as a relative liquidity premium between the two currencies. This means that the forward points do not only compensate for the interest rate differential between the two currencies, but that a liquidity premium must also be paid in order to obtain the currency in which there is a relative shortage.

If we insert (5) into (4), the premium in Nibor is given by

$$(6) rp_N = rp_{\$,N} + OISB_{\$,N}$$

²⁰ There is no OIS market for NOK, but Norges Bank estimates the OIS rate based on judgment for internal analytical purposes.

The risk premium in Nibor is equal to the sum of the risk premium in banks' US dollar rate and any liquidity premium between USD and NOK.

If we assume that the US dollar rate in Nibor is approximately equal to the Kliem rate²¹, the risk premium in Nibor can be decomposed further. The Kliem rate is a US dollar rate considered to express the cost to euro area banks of borrowing USD in the unsecured interbank market. The Kliem rate consists of the expected federal funds rate ($OIS_{\$}$) and a risk premium:

$$(7) i_{K,\$} = OIS_{\$} + rp_{K,\$}$$

where $i_{K,\$}$ is the Kliem rate and $rp_{K,\$}$ is the risk premium in the Kliem rate.

The Kliem US dollar rate is in practice the euro area money market rate Euribor swapped into USD. The Kliem rate can thus be written as

$$(8) i_{K,\$} = i_{\epsilon} + (f_{\epsilon,\$} - e_{\epsilon,\$})$$

where i_{ϵ} is Euribor and $f_{\epsilon,\$}$ is the forward exchange rate and $e_{\epsilon,\$}$ is the spot exchange rate between EUR and USD (number of USD per 1 EUR, where an increase implies a weaker dollar, both in logarithmic form).

Like other money market rates, Euribor consists of the expected policy rate plus a risk premium. Euribor can thus be written as

$$(9) i_{\epsilon} = OIS_{\epsilon} + rp_{\epsilon}$$

where OIS_{ϵ} is the OIS rate for EUR and rp_{ϵ} is the risk premium in Euribor. By inserting (9) into (8), the Kliem rate can be written as

$$(10) i_{K,\$} = OIS_{\epsilon} + rp_{\epsilon} + (f_{\epsilon,\$} - e_{\epsilon,\$})$$

By inserting (7) into (10), the risk premium in Kliem can be written as

$$(11) rp_{K,\$} = rp_{\epsilon} + (f_{\epsilon,\$} - e_{\epsilon,\$}) - (OIS_{\$} - OIS_{\epsilon})$$

By analogy with the OIS basis between USD and NOK, the OIS basis between EUR and USD reflects a relative liquidity premium between EUR and USD. This is given by the last part of equation (11), ie

$$(12) OISB_{\epsilon,\$} = (f_{\epsilon,\$} - e_{\epsilon,\$}) - (OIS_{\$} - OIS_{\epsilon})$$

Thus,

$$(13) rp_{K,\$} = rp_{\epsilon} + OISB_{\epsilon,\$}$$

By inserting (13) into (6), at the same time assuming that the US dollar rate in Nibor is equal to the Kliem rate (which implies that $rp_{\$,N} = rp_{K,\$}$), the risk premium in Nibor is given by

$$(14) rp_N = rp_{\epsilon} + OISB_{\epsilon,\$} + OISB_{\$,N}$$

²¹ The Kliem rate is quoted by the brokerage house Carl Kliem in Frankfurt.

The risk premium in Nibor can be expressed as the sum of the risk premium in Euribor, the relative liquidity premium between EUR and USD and the relative liquidity premium between NOK and USD.²²

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²² A USD shortage and thereby a relative liquidity premium on USD is reflected in a fall in the OIS basis between NOK and USD and an increase in the OIS basis between EUR and USD owing to the definition of exchange rates used here: the exchange rate between NOK and USD is defined as the number of NOK per 1 USD (a rise implies a stronger dollar), while the exchange rate between EUR and USD is defined as the number of USD per 1 EUR (a rise implies a weaker dollar).