

ECONOMIC COMMENTARIES

A decomposition of NIBOR

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KRISTIAN TAFJORD
MARKET OPERATIONS
AND ANALYSIS

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This commentary discusses the elements that comprise the Norwegian money market rate, NIBOR, given today's foreign exchange swap construction. Furthermore it explains how international conditions can affect Norwegian money market rates through this construction. This is particularly relevant following the announcement on 22 January 2015 of the European Central Bank's programme to purchase securities in the secondary market.

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The construction of NIBOR

NIBOR is constructed as a foreign exchange (FX) swap rate. In practice, this means that it is derived from a USD rate and the FX forward points (the forward premium) between USD and NOK. Each NIBOR panel¹ bank bases its NIBOR quote on the USD rate it deems best reflects its costs of borrowing USD in the unsecured interbank market. They adjust this rate for FX forward points between USD and NOK, which expresses the interest rate differential between Norway and the US, and are left with a "NOK rate". This "NOK rate", NIBOR, is an indication of the price of borrowing NOK in the unsecured interbank market. It can be written as

$$1) \quad (1 + i_{NIBOR}) = \frac{F}{S} (1 + i_{USD})$$

where S is the spot rate and F the forward rate (NOK per USD) and where i_{USD} is the USD rate applied by NIBOR panel banks in their quotes.² NIBOR is calculated as an average of the rates quoted by the NIBOR panel banks, once the highest and lowest rate has been discarded as laid down in the rules³. NIBOR is currently calculated with 1 week and 1, 2, 3 and 6 months maturity. The NIBOR rules are laid down by Finance Norway and the calculation agent is Oslo Stock Exchange.

The USD rate on which NIBOR is based

Before the financial crisis, NIBOR panel banks applied the USD LIBOR rate as a basis for their calculations of NIBOR. Even though LIBOR increased sharply following the Lehman bankruptcy in September 2008, it was widely claimed that the actual rate at which USD could be borrowed in the interbank market increased even more. In September 2008, the NIBOR panel banks decided to abandon LIBOR as a basis for NIBOR and base their quotes on an interest rate they considered to be more in line with their true costs. The NIBOR banks have reported that they have chosen to use the USD rate published by the interbank broker Carl Kliem in Frankfurt as a basis for NIBOR since the collapse of Lehman Brothers. Even though panel banks quote NIBOR based on the Kliem rate, they are free to adjust the USD rate so that it as closely as possible reflects the cost the bank faces should it borrow USD in

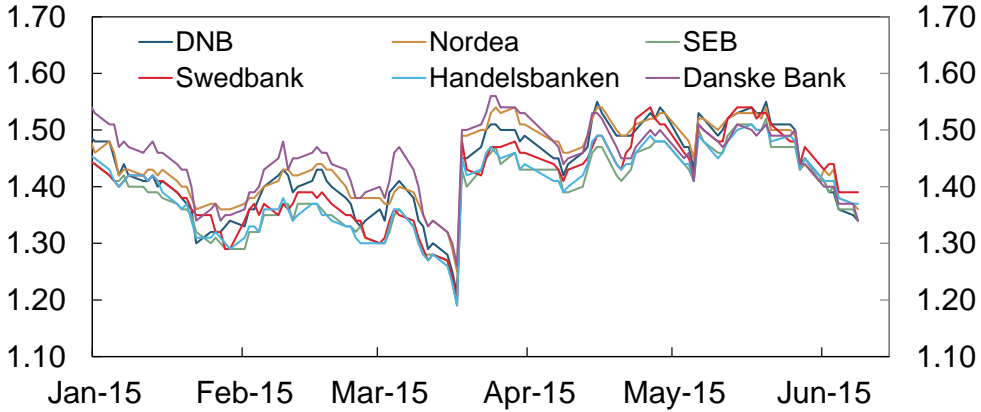
¹ The panel banks are currently DNB, Nordea, Skandinaviska Enskilda Banken, Danske Bank, Swedbank and Handelsbanken.

² The expression in equation (1) is in economic theory known as the covered interest rate parity condition. Covered interest rate parity is a "no-arbitrage condition" whereby gains/losses from interest rate differentials between two countries are counterbalanced by exchange rate developments in the relevant period.

³ For the NIBOR rules, click the following link: <https://www.fno.no/en/interest-rates/nibor---the-norwegian-interbank-offered-rate/>

the unsecured interbank market. In addition, the FX forward points applied by banks differ somewhat. As a result of these two factors, the panel banks' NIBOR contributions differ (see Chart 1).

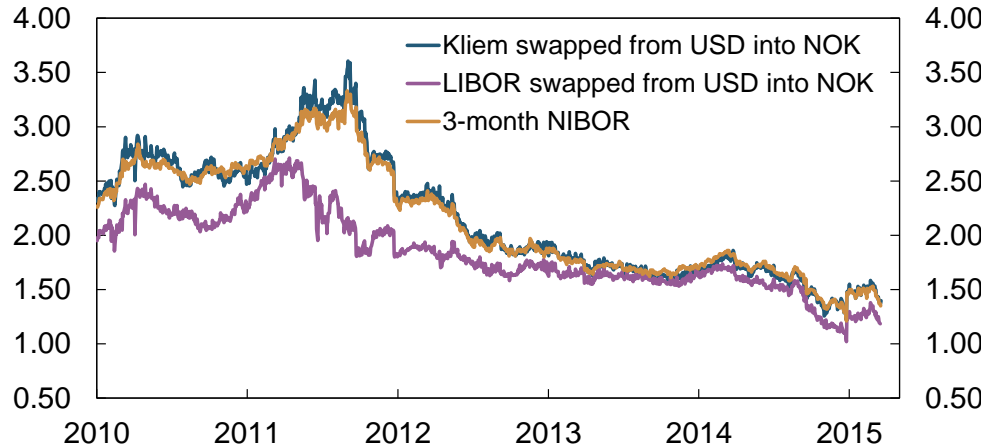
Chart 1: Daily three-month NIBOR quotes submitted by the six panel banks. 2 January 2015 – 9 June 2015. Percentage points.



Source: Bloomberg

As banks apply somewhat different USD rates and FX forward points, NIBOR cannot be exactly recreated by correcting the Kliem rate for the FX forward points between USD and NOK as quoted on Bloomberg or Thomson Reuters. However, you can get pretty close, as shown in Chart 2. This suggests that banks on average apply a USD rate that is close to the Kliem rate. The chart also shows, by comparison, that if the NIBOR banks had based their quotes on USD LIBOR, the Norwegian interbank rate would have been lower.⁴

Chart 2: Three-month NIBOR, Kliem swapped from USD into NOK and LIBOR swapped from USD into NOK. 25 March 2010 – 9 June 2015. Daily data. Percentage points.



Sources: Bloomberg and Thomson Reuters

⁴ In Chart 2, the NOK rates have been swapped from USD LIBOR and Kliem respectively, estimated based on equation (1), where the two USD rates are corrected for FX forward points.

The USD Kliem rate is supposed to reflect the cost to euro area banks of raising USD funds in the unsecured interbank market. In practice, the Kliem rate is the European money market rate EURIBOR, swapped into USD. EURIBOR comprises European policy rate expectations, as expressed by the OIS (Overnight Index Swap) rate, plus a risk premium. Kliem can be expressed as the sum of EURIBOR and the FX forward points (measured in basis points) between USD and EUR (see Chart 3).

Chart 3: Expression of the Kliem USD rate.

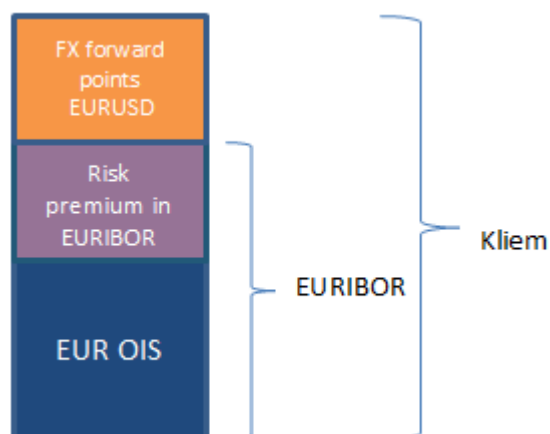


Chart 3 expressed as an equation gives the following:

$$2) \text{ Kliem} = \text{OIS}_{EUR} + rp_{EUR} + tp_{EURUSD}$$

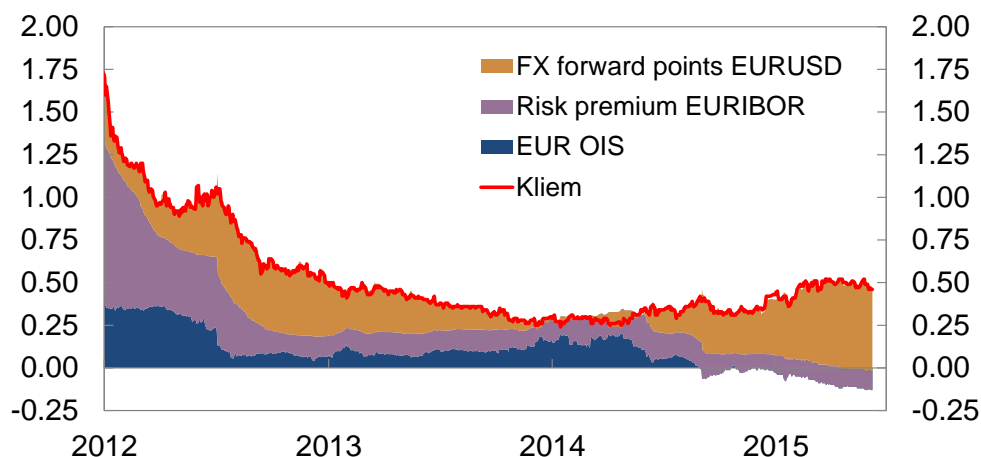
where rp_{EUR} is the risk premium in EURIBOR and tp_{EURUSD} is the FX forward points between EUR and USD.⁵ Chart 4 shows the decomposition of 3-month Kliem as shown in Chart 3 with historical data.

⁵ Analogous to the construction of NIBOR, when the Kliem rate is EURIBOR swapped into USD, Kliem can be written as

$$(1 + i_{Kliem}) = \frac{F^*}{S^*} (1 + i_{EUR})$$

where S^* is the spot rate and F^* is the three-month forward rate, in USD per EUR, so that an increase leads to a weaker dollar and a stronger euro. Writing the equation in logarithmic form gives $i_{Kliem} = i_{EUR} + (f^* - s^*)$. Inserting the OIS rate and the premium for EURIBOR, where $rp_{EUR} = i_{EUR} - \text{OIS}_{EUR}$, gives $i_{Kliem} = \text{OIS}_{EUR} + rp_{EUR} + (f^* - s^*)$, which is equation (2) in the main text.

Chart 4: Decomposition of 3-month Kliem. 2 January 2012 – 9 June 2015. Daily data. Percentage points.



Sources: Bloomberg and Thomson Reuters

Kliem can also be expressed in an alternative way. If we start with the European OIS rate, which expresses policy rate expectations in the euro area, and swap this rate into USD, in line with the covered interest parity condition, this produces an implied OIS rate in USD. This implied OIS rate indicates what the actual OIS rate in USD should be if covered interest rate parity holds between the OIS rates. An implied USD OIS rate that is higher than the USD OIS rate actually observed in the market indicates that covered interest parity does not hold.⁶ It could be said in this case that there is a “shortage premium” on USD relative to EUR.⁷ This means that the FX forward points between EUR and USD do not only compensate for the interest rate differential between the two currencies, as given by covered interest rate parity, but that a “shortage premium” must also be paid in order to exchange EUR for USD in the FX forward market.⁸

The difference between the implied USD OIS rate and the actual USD OIS rate, which expresses the size of the “shortage premium”, is called the EURUSD OIS basis (see Chart 5).

⁶ Normally, the OIS rate in EUR swapped into USD should be very close to the USD OIS rate. This is because both interest rates are virtually risk-free as the OIS rate reflects expected policy rates, i.e. the interest rate banks receive on reserves deposited with the central bank. A difference between the rates provides opportunities for arbitrage. See Bernhardsen, Kloster and Syrstad (2012), “Risk premiums in NIBOR and other countries’ risk premiums”, Staff memo (2012), Appendix A for details.

⁷ If this is the case, then $OIS_{USD} < OIS_{EUR} + (f^* - s^*)$. A shortage of USD will prompt market participants to obtain USD via the FX forward market. They will buy USD spot and EUR forward. This strengthens EUR relative to USD, giving $\Delta f > 0$. The forward premium thereby increases, so that the EUR OIS rate swapped into USD is higher than the USD OIS rate.

⁸ Similarly, if the implied OIS rate is lower than the actual rate, it could be said that there is a “shortage premium” on EUR relative to USD.

Chart 5: Definition of the EURUSD OIS basis.

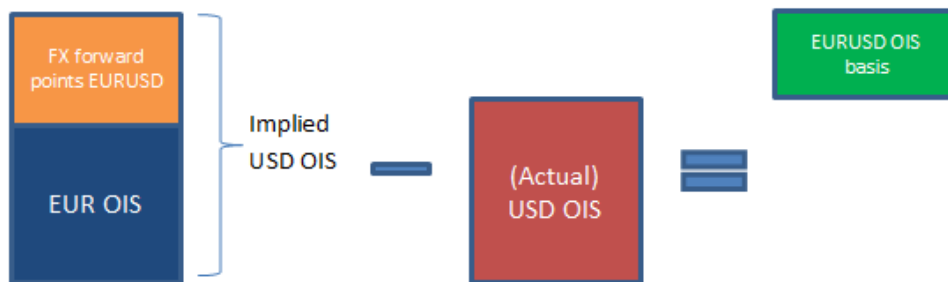


Chart 5 expressed as an equation gives

$$3) (OIS_{EUR} + tp_{EURUSD}) - OIS_{USD,actual} = OISbasis_{EURUSD}$$

which can easily be rewritten as

$$4) (OIS_{EUR} + tp_{EURUSD}) = OIS_{USD,actual} + OISbasis_{EURUSD}$$

By combining equation 4 with equation 1, we can rewrite the expression for the Kliem rate as shown in Chart 6.

Chart 6: Alternative expression of the Kliem rate.

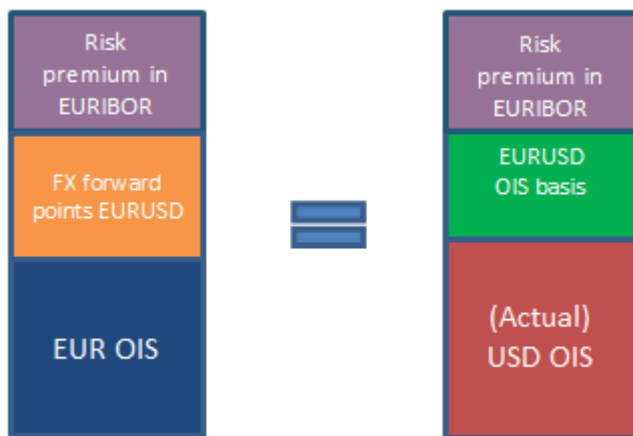


Chart 6 expressed as an equation gives

$$5) \quad \begin{aligned} \text{Kliem} &= OIS_{EUR} + rp_{EUR} + tp_{EURUSD} \\ &= OIS_{USD,actual} + rp_{EUR} + OISbasis_{EURUSD} \end{aligned}$$

If panel banks base their NIBOR quotes on the Kliem rate, NIBOR can be expressed as the sum of Kliem and the FX forward points between USD and NOK, as shown in Chart 7.

Chart 7: NIBOR based on the USD Kliem rate.

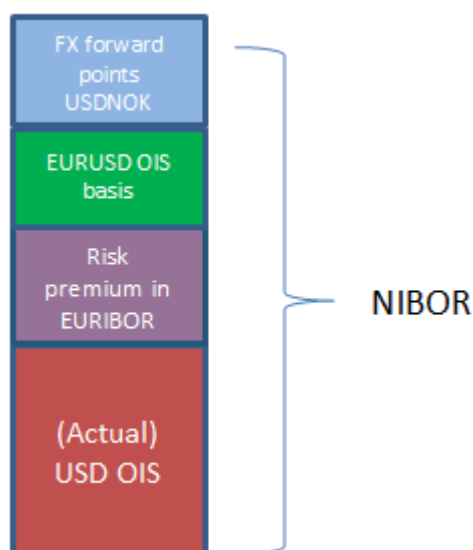
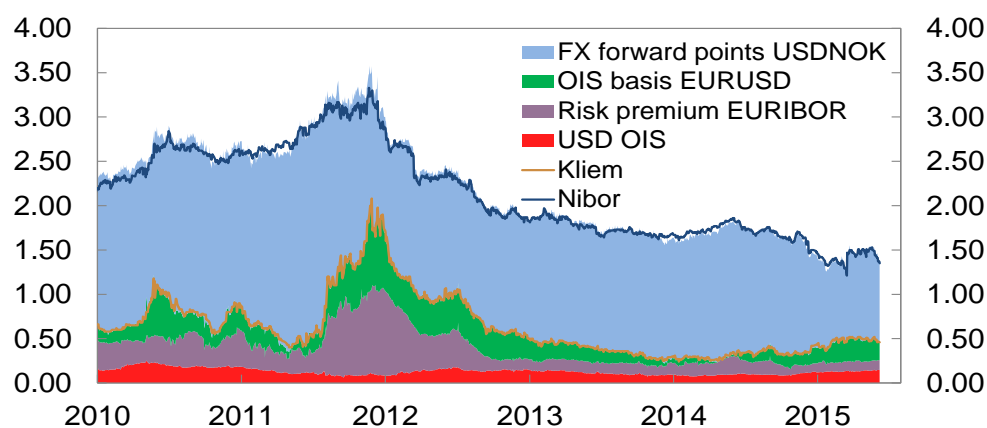


Chart 7 expressed as an equation:

$$\begin{aligned}
 6) \quad NIBOR &= Kliem + tp_{USDNOK} \\
 &= OIS_{USD,actual} + rp_{EUR} + OISbasis_{EURUSD} + tp_{USDNOK}
 \end{aligned}$$

Chart 8 shows the decomposition of 3-month NIBOR as shown in Chart 7, with historical data.⁹ As there has been a marked interest rate differential between Norway and the US for some time, the FX forward points account for the largest block in the figure.

Chart 8: Decomposition of 3-month NIBOR as shown in Chart 7. Daily data. 2 January 2010 – 9 June 2015. Percentage points.



Sources: Bloomberg and Reuters

⁹ There may be several reasons why NIBOR does not exactly follow the top of the blue area. One reason could be that the USD rate applied in the calculation of NIBOR is not exactly the same as the Kliem rate. Another reason is that banks use different FX forward points in their quotes. Furthermore the data used in these calculations is not necessarily from exactly the same time of day.

Like other IBOR rates, NIBOR can in principle be decomposed into policy rate expectations and a risk premium. As for EURIBOR, the risk premium in NIBOR expresses the extra return banks require to lend reserves in the unsecured interbank market rather than depositing these reserves with the central bank at the key policy rate. Since there is no Norwegian OIS market, it is difficult to identify the share of NIBOR that is key policy rate expectations and thus also to define the size of the risk premium. The interpretation of NIBOR as a “NOK interest rate” is thus an equation with three variables, where only NIBOR itself is observable.

$$7) \text{ 3-month NIBOR} = \text{3-month key policy rate expectations} + \text{risk premium}$$

Only when it is more than three months until the next monetary policy meeting at Norges Bank can we observe directly the size of the different components of three-month NIBOR. This is because at that time we are sure that the key policy rate will not be changed in the course of the period.¹⁰ As soon as the three-month period stretches beyond a monetary policy meeting, assumptions have to be made in order to deduce market key policy rate expectations from NIBOR. In these periods, it is difficult to know whether changes in NIBOR are the result of changes in key policy rate expectations or a change in the risk premium.

Chart 7 shows that the US OIS rate is one of the components of NIBOR. Naturally, it makes little sense that changes in US policy rate expectations in isolation should influence a Norwegian interbank interest rate. And normally they will not do so. An increase in US policy rate expectations, for a given level of Norwegian policy rate expectations, should be counterbalanced by a lower FX forward premium between USD and NOK, and vice versa.^{11,12}

Changes in the two remaining elements of NIBOR, the risk premium in EURIBOR and the EURUSD OIS basis, are not, however, necessarily counterbalanced by any of the other elements. International factors that affect these elements can thereby also affect NIBOR.

Connection between NIBOR and the euro area

The risk premium in EURIBOR expresses the extra return euro area banks would require to lend reserves to each other in the unsecured interbank market. When euro area banks find lending reserves to other euro area banks riskier, or the liquidity situation in the euro area becomes “tighter”, this premium rises. Even though it is not a given that the risk associated with interbank lending between Norwegian banks will thereby increase, or the liquidity situation in NOK has changed, the premium in NIBOR can rise as a result. During the euro crisis in 2012 in particular, a marked increase in the risk premium in EURIBOR passed through to NIBOR, which also resulted in a very high risk premium in Norwegian interbank rates (see Chart 8).

¹⁰ Assuming there are no expectations of extraordinary monetary policy meetings.

¹¹ Assuming that the OIS basis between USD and NOK remains unchanged.

¹² Changes in Norwegian key policy rate expectations will also affect NIBOR via FX forward points between USD and NOK.

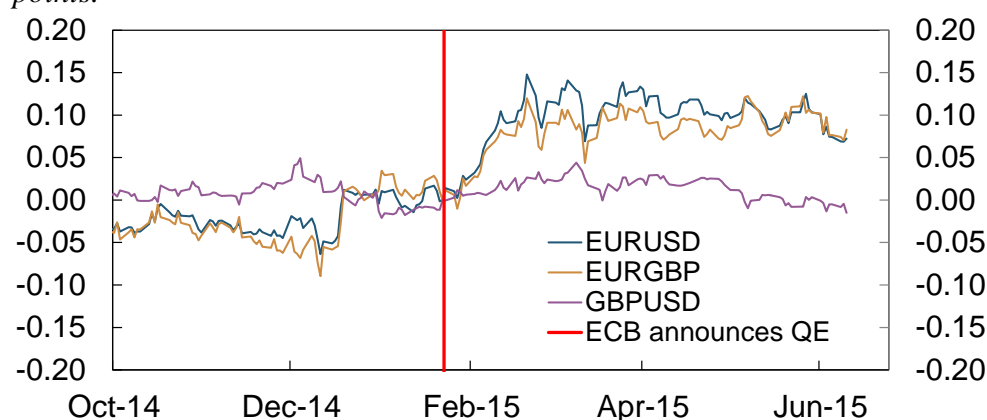
As mentioned above, the EURUSD OIS basis is an expression of the “shortage premium” on USD relative to EUR. This premium will be influenced by factors such as the relative supply of EUR relative to USD. A higher “shortage premium” on USD relative to EUR has the effect of raising the risk premium in the Klieim rate, given that the risk premium in EURIBOR does not fall to the same extent. If an increase in the risk premium in the Klieim rate is not counteracted by a change in the FX forward premium between USD and NOK, the risk premium in NIBOR will also rise.

The NIBOR risk premium so far in 2015

The relationships described above became particularly relevant with the announcement on 22 January 2015 of the European Central Bank’s programme to purchase securities in the secondary market (also known as quantitative easing or QE). Under the programme, the ECB plans to inject EUR 60 billion a month into the market until end-September 2016. The ECB’s aim is to bring the size of its balance sheet back to its 2012 level. All else being equal, this means that the ECB will add around EUR 1100 billion to the European banking system.

Quantitative easing by the ECB has probably contributed, and will continue to contribute, to a higher “shortage premium” on USD relative to EUR. However, it is important to point out that this “shortage premium” has its origin in a higher supply of EUR liquidity, not a general USD shortage. This is illustrated in Chart 9, which shows the OIS basis between selected currencies. As shown in the chart, the “shortage premium” between EUR and USD and between EUR and GBP increased relatively sharply after 22 January. The fact that the OIS basis between GBP and USD remained relatively stable in the same period illustrates the assertion that the “shortage premium” is due to a higher supply of EUR and not a general shortage of USD liquidity.

Chart 9: Three-month OIS basis between selected currencies. Indexed to zero 22 January 2015. 2 October 2014 – 9 June 2015. Daily data. Percentage points.

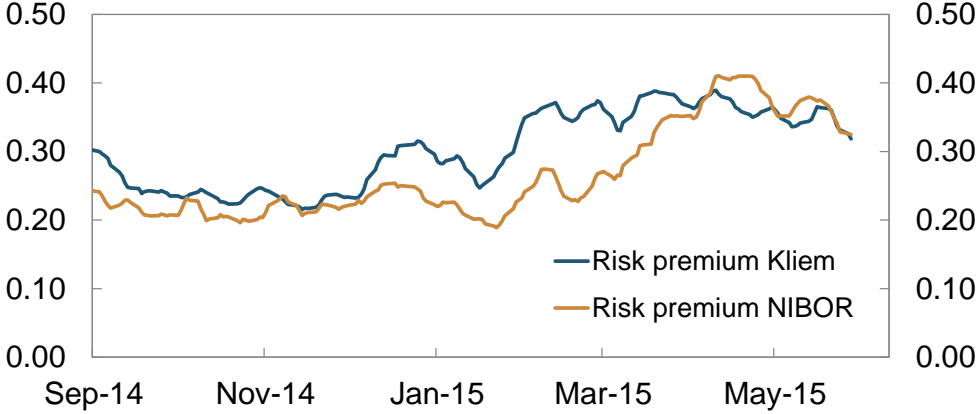


Sources: Bloomberg and author's own calculations

The increase in the OIS basis between EUR and USD pushed up the risk premium in the Klieim rate by 14 basis points, from 25 to 39 basis points, in the period 22 January to mid-April. The risk premium in NIBOR increased by

about 20 basis points, from 20 to around 40 basis points, in the same period.¹³ Since then, the risk premium in both Kliem and Nibor has decreased somewhat and they are now both just above 30 basis points (see Chart 10).

Chart 10: The risk premium in Kliem and in NIBOR. 2 October 2014 – 9 June 2015. 5-day moving average. Percentage points.



Sources: Thomson Reuters and Norges Bank estimates

With a substantial increase in the amount of reserves in the European banking system, it is possible that euro area banks will require a smaller premium for unsecured lending of reserves in the interbank market. It is therefore not unreasonable to assume that the risk premium in EURIBOR will fall somewhat and contribute to counterbalancing some of the effect on NIBOR of any increase in the OIS basis between EUR and USD. The premium in EURIBOR is, however, already as low as 10 basis points, and there is probably a limit to how much further it will fall.

Since the ECB will continue to supply EUR liquidity, the positive “shortage premium” on USD relative to EUR is likely to persist for some time ahead, or indeed rise to an even higher level. This may indicate that the NIBOR premium will continue to be somewhat higher than would otherwise have been the case in the period ahead. It is, however, important to emphasize that any attempt to estimate both the current and the future risk premium in NIBOR is subject to a considerable amount of uncertainty.

Summary

The Norwegian money market rate, NIBOR, is constructed as a foreign exchange swap rate. As such, NIBOR can be affected by international conditions that might not otherwise be expected to affect a Norwegian interbank rate. NIBOR is particularly closely linked to economic conditions in Europe and the US as NIBOR is calculated based on the European money market rate EURIBOR, swapped into USD in the foreign exchange market.

¹³ The increase in the NIBOR premium can probably be partly attributed to low structural liquidity in Norway. This creates a "shortage premium" on NOK when the Kliem rate is swapped from USD to NOK in the FX market. The contribution from this part of the foreign exchange swap construction has probably had a limited effect on the recent increase in the NIBOR premium and is therefore not the focus of this paper.

Thus, international shocks, such as quantitative easing in the euro area, may influence the level of the Norwegian money market rate.

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