

NORGES BANK PAPERS

Weaknesses in NIBOR

NO. 2 | 2014



NORGES BANK

Norges Bank Papers no. 2 | 2014

Norges Bank

Address: Bankplassen 2

Postal address Postboks 1179 Sentrum, 0107 Oslo

Phone: +47 22316000

Fax: +47 22413105

E-mail: central.bank@norges-bank.no

Website: www.norges-bank.no

ISSN 1894-0277 (online)

ISBN 978-82-7553-814-5 (online)

NORGES BANK

MB/MOA

APPENDIX TO LETTER OF 26.5.14 TO FINANSTILSYNET

Weaknesses in NIBOR

1. Introduction

The aim of interest rates such as LIBOR, EURIBOR and NIBOR is to reflect the average interest rate level for unsecured money market lending between solid banks. NIBOR is the rate for Norwegian kroner and EURIBOR for Euro. There are LIBOR interest rates in USD and four other currencies. Sweden and Denmark also have their own benchmark rates, STIBOR and CIBOR.

One of the fundamental challenges related to these rates is that they are not based on actual transactions. There are very few unsecured interbank loan transactions with maturities of more than a few days. In Norway and in other countries, IBOR rates refer to lending that does not actually take place. At the same time, these rates cannot simply be abolished: they have an established position as a reference rate for other types of loan contracts and not least as a reference for various derivatives, many of which have long maturities. In the short term, it is difficult to envisage how IBOR rates could be replaced by other rates.

The fact that the most important reference rates in the economy are not based on actual trades is a dilemma. In other countries, this dilemma has been resolved by allowing banks in the relevant market to estimate an unsecured rate. A question defined in the rules is put to the banks each day. The question, in slightly varying forms, is what the banks estimate an unsecured interbank loan would have cost had the loan transaction taken place. International reference rates are thus based on banks' best judgement. Banks base their judgement on factors such as the cost of obtaining short-term loans (from agents outside the banking sector) and the premium they would require to lend the funds on to another bank.

Manipulation and misreporting of benchmark rates have been the focus of attention in recent years. The rates are vulnerable to manipulation because there is no set answer as to what they should be. Supervisory authorities in several countries have established that banks deliberately deviated from their best judgement in their rate submissions. The revelations have undermined general confidence in benchmark rates. In other countries, national authorities and banking sector organisations have been working on reforms over the past few years aimed at restoring confidence. Banks that were caught cheating have been fined.

Banks in Norway set the benchmark rate using a different approach. Even though NIBOR is also defined as banks' estimate of what an unsecured interbank loan would have cost,¹ banks have chosen a different approach in order to arrive at the answer. Instead of using judgement in order to estimate the Norwegian benchmark rate directly, the rate is derived from a foreign interest rate. NIBOR is based on an unsecured interbank USD rate, which is "translated" into a Norwegian rate via the price of exchanging USD for NOK in the foreign exchange swap market. NIBOR thus comprises two components: an interbank interest rate in USD and the price quoted in the fx swap market. Even though trades take place in the fx swap market, this construction does not mean that NIBOR is a traded rate.

The connection to the fx swap market makes NIBOR considerably more volatile than other countries' benchmark rates. Because of the volatility imported from the forward premium, the difference between NOK/USD spot and forward rates, changes in NIBOR can be very difficult to understand for agents other than the NIBOR panel banks. An agent with exposure to NIBOR in the derivatives market is faced with substantial additional uncertainty in that NIBOR's value on the maturity date is unpredictable. Even if the agent accurately predicts the Norwegian key policy rate, his prediction of NIBOR can miss by a wide margin. The deviation can also be difficult to explain in terms of risk premiums on interbank loans in NOK. Because of the uncertainty related to NIBOR, economic agents may avoid Norwegian financial markets, resulting in lower liquidity in these markets than could otherwise have been the case.

¹ The closest to a definition of NIBOR in the rules and regulations is the following, which states that each bank's submission is intended to "[...] *reflect the interest rates the bank would charge on lending in NOK to a leading bank that is active in the Norwegian money and foreign exchange markets.*"

It has been claimed that because of the connection to the fx swap market, NIBOR reflects market conditions better than other countries' benchmark rates and is thus a "more correct" rate.² This argument relies on the assumption that NIBOR correctly reflects the conditions for NOK liquidity supply and demand. Norges Bank does not disagree that the forward premium reflects NOK liquidity supply and demand. The fx swap market is liquid and the bid-ask spread is low. A change in demand for NOK against USD will quickly be reflected in the forward premium.

If NOK liquidity conditions were correctly reflected in NIBOR, the forward premiums applied by the six panel banks should be very similar; they are measured at the same time of day (12 noon) and are taken from a liquid fx swap market, which expresses the liquidity premium for NOK. A liquidity premium for NOK must apply to the market in general and be the same for all banks. This means that any differences between banks' individual contributions to NIBOR must primarily be the result of differences in the USD rate. If banks base their contributions on their own estimated funding costs in USD, the rate may not be quite the same for good reason: a bank with a high credit rating will typically face a lower USD rate than a bank with a lower rating. Relative creditworthiness, however, does not change materially from one day to the next. A bank with a higher credit rating than another bank today will normally retain that rating over the following days.

Norges Bank has studied high-frequency data from Thomson Reuters for individual NIBOR panel banks' quoting of the forward premium and NIBOR through the day. These data make it possible to ascertain whether banks' quoted forward premiums in fact reflect a common liquidity premium, and whether there is any systematic pattern in the relative USD rates applied by banks. Using tick data, we have calculated data for individual banks with a 15-minute sampling frequency by allowing the last quote within a 15-minute interval to be the bank's quote for this interval. For example, if the last quote of the forward premium in the interval 10.00 -10.15 is made at 10.13, this quote is taken as the bank's quote of the forward premium for the interval

² Finance Norway's letter to Norges Bank of 31 January 2014 states the following: "*Furthermore, it is the opinion of Finance Norway that using forward premiums when calculating NIBOR results in a benchmark rate that is more closely aligned with the market. NIBOR will then to a greater extent reflect changes in liquidity demand in the Norwegian market, which must be considered one of NIBOR's strengths compared with some other IBOR rates.*"

10.00-10.15. The same procedure is followed for the NOK rate. A bank's quote of the NOK rate at 12.00 will be the bank's contribution to NIBOR.

Using this data set, we examine individual banks' quotes of (i) NIBOR, (ii) the forward premium, and (iii) the USD rate on which NIBOR is implicitly based.

2. Banks' individual NIBOR submissions

NIBOR is calculated every day as the average of the rates submitted by the six NIBOR panel banks at 12.00 after the highest and lowest rate has been discarded. The average of the four remaining rates will be that day's NIBOR (also known as the NIBOR fix).

Chart 1 shows the spread between each bank's NIBOR contribution at 12 noon and the actual fix for NIBOR the same day. There is a panel in the chart for each of the six NIBOR panel banks (here denoted A-F). The period shown is from January 2010 to December 2013. Each dot in the chart shows the deviation between the relevant NIBOR bank's contribution and the fix on a given day. Fluctuations in NIBOR owing to general market movements are filtered out when individual banks' NIBOR quotes are compared with the fix. Differences in quoting across banks show that banks charge different interest rates on a NOK loan at the same point in time. The chart shows that banks' individual NIBOR contributions can deviate from the fix by up to 10 basis points.

Some difference between banks' individual NIBOR contributions is not necessarily a problem. Even though the forward premium should be more or less exactly the same for all banks, there may be a slight difference between the USD rates they use as a basis. The main problem expressed in Chart 1 is that although individual banks are above or below the average of the other banks for long periods, there is no systematic pattern in evidence. The deviations seem to vary at random from one day to the next: a bank can be 5-10 basis points higher than the others on one day, and 5-10 basis points below the others the next. It is not easy to identify the economic realities that are reflected in such a picture.

Another observation in Chart 1 is the clear decrease in the dispersion of individual banks' NIBOR contributions after February 2012. In meetings with Norges Bank, the banks have attributed the change to a decrease in fluctuations in the USD rate on which NIBOR

contributions are based. Before February 2012, the USD rate used by banks as a basis for NIBOR fluctuated considerably through the day. Banks indicate that this may have affected the individual NIBOR contributions as not all banks update their USD rates at the same time. Some banks may, for example, update at 10:00 and others just before 12 noon. With high volatility through the day, NIBOR contributions will be based on different USD rates and the contributions will differ. This explanation seems to strengthen the view that the swap construction used for NIBOR does not reliably reflect the price of an unsecured interbank loan in NOK at 12.00 every day.

Chart 1. Spread between individual NIBOR panel banks' contributions and the actual NIBOR fix. Three-month maturity. January 2010 – December 2013. Percent

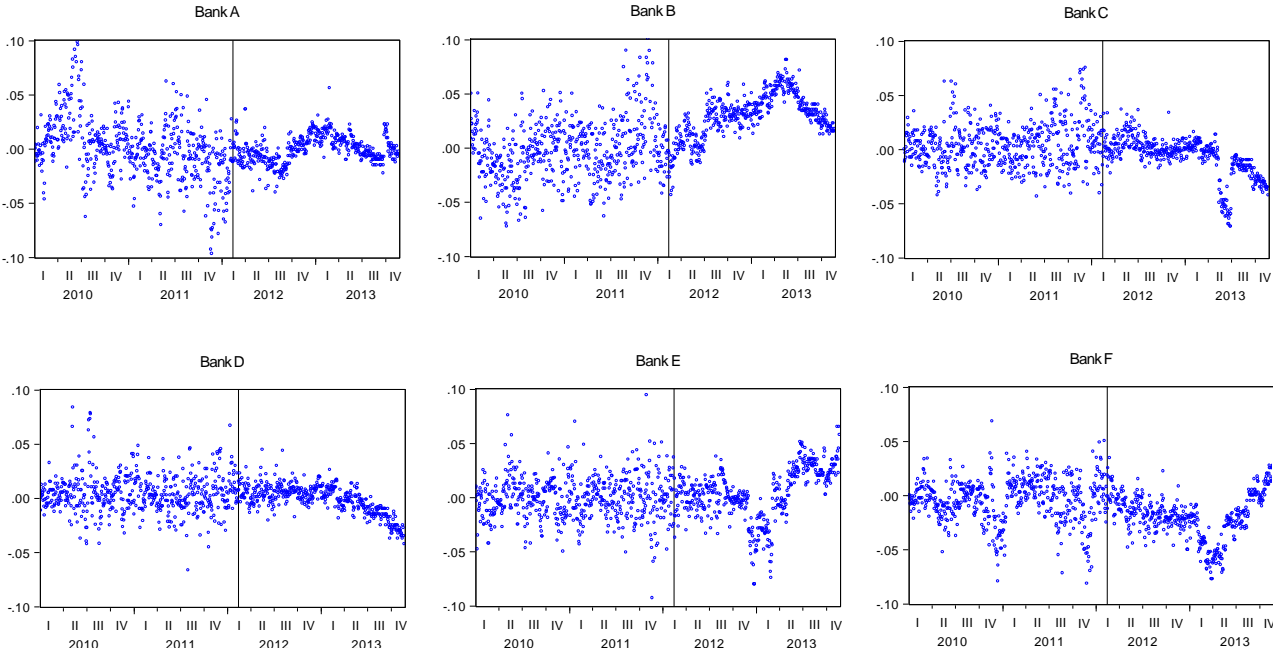


Chart 2. Spread between individual quotes and the LIBOR fix. Three-month maturity. 1 January 2010 –1 June 2013. Percent

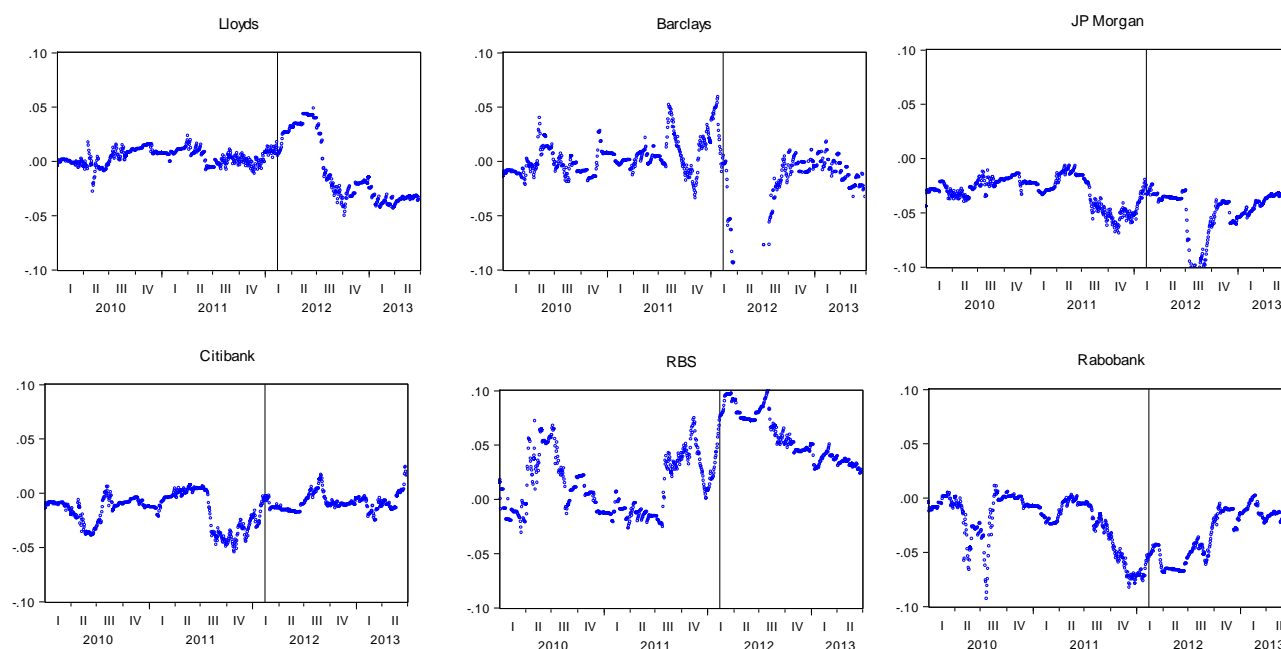
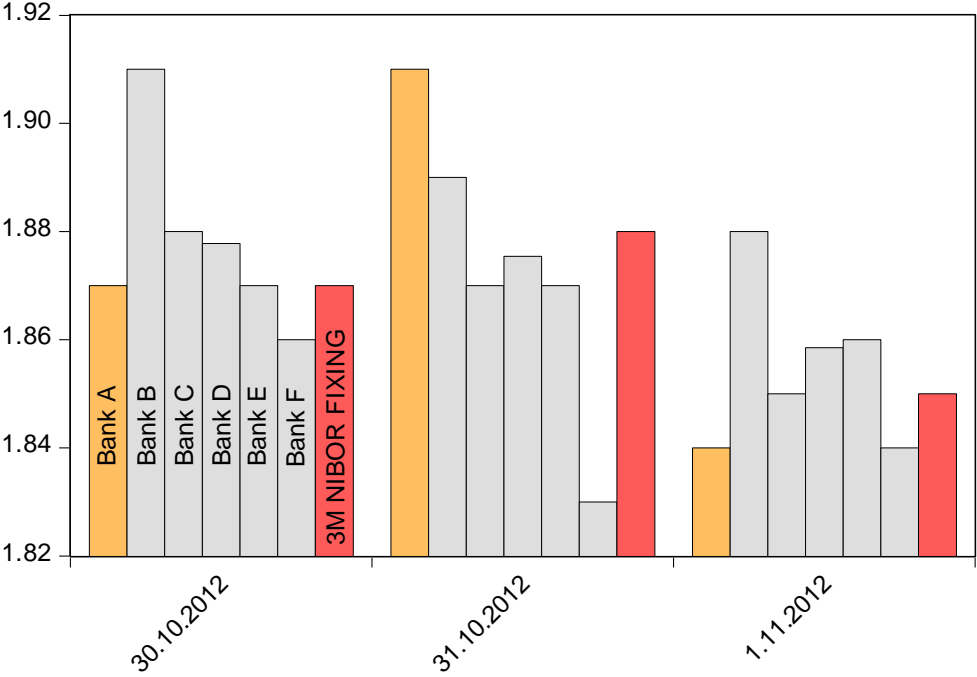


Chart 2 shows the spread for six randomly selected LIBOR banks’ contributions to USD LIBOR for comparison. The panels in Chart 2 are constructed in the same way as the panels in Chart 1. Each panel shows the deviation of one bank’s contributions from the valid average published as the LIBOR rate every day. LIBOR is derived from panel banks’ judgement-based estimates of the rate they would have to pay for unsecured borrowing from another bank.³ As illustrated in the charts, the daily variation in LIBOR banks’ individual contributions is considerably smaller than is the case for NIBOR. The spread between contribution and fix for LIBOR banks follows a much clearer pattern and is not alternately positive and negative as is the case for NIBOR. When a LIBOR bank quotes a rate that is above the average of the other banks, this situation lasts over time, indicating that this bank assesses its funding costs to be somewhat higher than the average for the other banks. Such a picture is considerably easier to interpret.

³ The LIBOR rate is based on panel banks’ answer to the following question, which is put to them every day: “At what rate could you borrow funds, were you to do so by asking for and then accepting interbank offers in a reasonable market size just prior to 11 am London time?” Note the formulation “asking for and then accepting” in this question: banks are asked to estimate the rate they would be offered by another bank. In other words, LIBOR expresses an ask-rate (“offered rate”) in the same way as EURIBOR, NIBOR and other IBOR rates.

The main impression from Charts 1 and 2 is that there are considerable fluctuations in the individual NIBOR panel banks' contributions that are difficult to explain if they represent changes in the liquidity premium for NOK. As daily variations are difficult to pick out in Charts 1 and 2, Chart 3 provides an example of this type of fluctuation over a shorter period of time. The chart shows the six NIBOR panel banks' individual NIBOR contributions over a three-day period, from 30 October to 1 November 2012, and the NIBOR fix, which is the average of the four remaining contributions.

Chart 3. Individual contributions to NIBOR and the NIBOR fix 30 October –1 November 2012. Three-month maturity. Percent



Four of the six panel banks reduced their contribution to NIBOR between 30 and 31 October. This should indicate that the USD rate used as a basis by the panel banks decreased and/or that the forward market priced in a fall in the liquidity premium or key rate expectations in NOK relative to USD. However, one of the banks (Bank A in the chart) moved in the opposite direction from the others and increased its NIBOR contribution by 4 basis points. As a result, NIBOR *increased* by one basis point between 30 and 31 October, even though the majority of

the banks in the panel submitted lower rates. Bank A changed from submitting one of the lowest rates on 30 October to submitting by far the highest on 31 October. The following day, 1 November, Bank A reduced its NIBOR contribution considerably, by as much as 7 basis points, again submitting one of the lowest rates in the panel and contributing to a marked fall in NIBOR between 31 October and 1 November.

This example illustrates several deficiencies in the current construction of NIBOR. First, it shows NIBOR's lack of robustness to a single bank's contribution. With a small number of banks in the panel, a change in one contribution can affect the average, even if this bank's contribution is omitted.⁴ Second, it is difficult to see how these individual contributions could all reflect changes in demand for liquidity in the Norwegian market. Why does Bank A require a higher lending rate on 31 October when the other banks require a lower rate? And why is it that the following day the same bank submits the lowest interbank lending rate?

3. The forward premium as a basis for NIBOR

The fx swap market transforms a USD rate into NIBOR and is the reason why NIBOR is claimed to be more closely aligned with the market than other benchmark rates. The fx swap market is normally highly liquid. Many foreign banks participate in this market in addition to NIBOR panel banks, and the bid-ask spread quoted by banks active in the market is small. For three-month maturity, the spread is seldom larger than 5 forward points, or about 2-3 basis points, when the forward premium is translated into an interest rate differential between the two currencies.⁵ Even though the quoted bid and ask prices are not binding, trades between banks normally occur within this narrow interval.

However, NIBOR is not based on this narrow bid-ask spread. NIBOR panel banks report that they have a mutual agreement to quote binding forward premiums. They have made a commitment to trade a given amount at the quoted rates. The commitment only applies to the

⁴ When a bank increases its quoted rate to such an extent that it is omitted from the valid average, the next highest quoted rate (which would otherwise have been omitted) will be among the four valid rates.

⁵ The forward premium is the difference between the forward rate and the spot rate in a trade involving two currencies. If the USD/NOK forward rate ahead is 6.0123 and the spot rate is 6.0000, the forward premium is 123. The forward premium is measured in forward points and can be translated into an implied interest rate differential. Pricing of the forward premium in the market is based on the difference between the expected overnight rates in the two countries. See Norges Bank *Staff Memo* 21/2012 for further details.

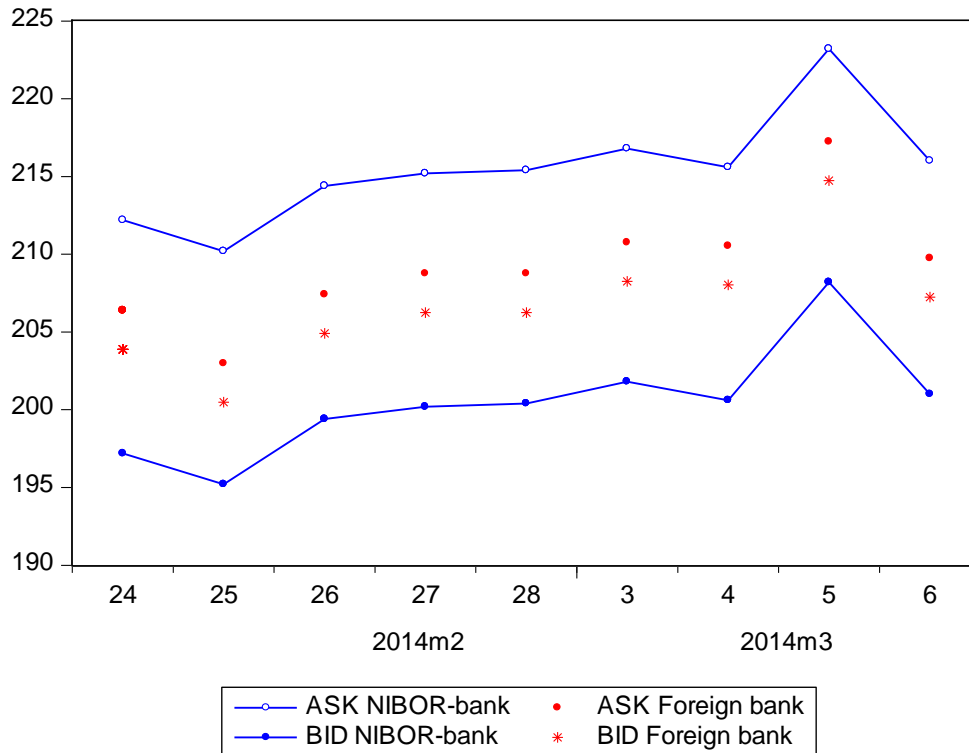
other banks in the NIBOR panel. The NIBOR panel banks fulfil this commitment by quoting a bid-ask spread that is considerably wider than the narrow spread used for trades in the market. With a wide spread, they are protected against the risk of having to conduct trades at an unfavourable price. It is the ask price in this wide spread that is used in the calculation of NIBOR.⁶ Each bank's contribution to NIBOR thus consists of the USD rate applied by the bank and the binding ask price quoted by the bank to other NIBOR panel banks when NIBOR is fixed at 12 noon.

Chart 4 illustrates this relationship. The chart shows how a randomly selected NIBOR bank and a randomly selected foreign bank quoted their bid and ask prices for the forward premium for USD/NOK on Thomson Reuters every day at 12.00 in the period from 24 February to 6 March 2014. The foreign bank quoted bid and ask prices every day with a spread of 2-3 forward points. The spread for the NIBOR bank was considerably wider, at 15 forward points. Even though banks quote their indicative prices electronically, actual trades are agreed bilaterally, for example by telephone, where the parties agree on a price. Any actual trades during this window were most likely conducted at prices within the narrow spread quoted by the foreign bank. Any trades by the relevant NIBOR banks were probably also conducted at prices within this narrow interval, even though NIBOR quotes are based on the broad interval.

⁶ After the Lehman bankruptcy in autumn 2008, NIBOR banks increased their spread considerably, and from 16 November 2009 until 15 June 2011 they maintained a spread of 25 forward points, or between 10 and 15 basis points. On 15 June 2011, NIBOR banks reduced the spread to 15 forward points. This is still considerably wider than the spread of 3-5 forward points used in actual trades.

Chart 4. Observed quotes of the three-month forward premium for USD/NOK (bid and ask) on Thomson Reuters, 24 February – 6 March 2014. One NIBOR bank and one foreign bank.

Forward points



The picture in Chart 4 applies in general: the ask price quoted by NIBOR panel banks is substantially above the price traded at in the market and the bid price is substantially below. This means that NIBOR panel banks can in principle move their quotes up or down within a fairly wide range without risking that another bank will want to trade at this price. In other words, NIBOR panel banks have considerable leeway to adjust their ask prices, on which NIBOR is based, up or down. This practice for forward premium quoting raises questions as to how closely aligned with the market NIBOR really is. Thus, in addition to being able to change the USD rate used as a basis (discussed below), NIBOR panel banks can influence NIBOR without this being reflected in general market movements.

In conversation with one of the NIBOR panel banks, we were informed that the bank also offers a narrow spread on other trading platforms, in line with that of foreign banks, and that the wide spread, on which NIBOR is based, is always a symmetrical range around the narrow spread.

When the narrow spread is moved up or down, the wide “NIBOR spread” automatically moves in tandem. Statistical data to confirm this pattern have been requested, but so far not received.

The high-frequency data obtained from Thomson Reuters shows how NIBOR panel banks quote their wide spreads through the day. If NIBOR is aligned with the market and is correct, the ask price in this spread at 12 noon should reflect demand for liquidity in the Norwegian market at the same time of day. We find many examples where it is difficult to see how individual banks’ forward premium quotes can reflect the general conditions for NOK liquidity.

Charts 5a and 5b show the forward premiums and associated interest rates quoted by two NIBOR panel banks at 15-minute intervals between 11.00 and 16.00 on 29 January 2009. Chart 5a shows the two banks’ quoted forward premiums. The forward premium at 12 noon, together with a USD rate, forms the basis for the banks’ rate contributions at 12 noon. The two banks’ rate contributions in the same period are shown in Chart 5b. The bars for the interest rate at 12 noon show each bank’s contribution to NIBOR that day.

Chart 5a. Forward premiums quoted by two NIBOR panel banks (ask price), 29 January 2009 11.00 –16.00. Three-month maturity. Forward points

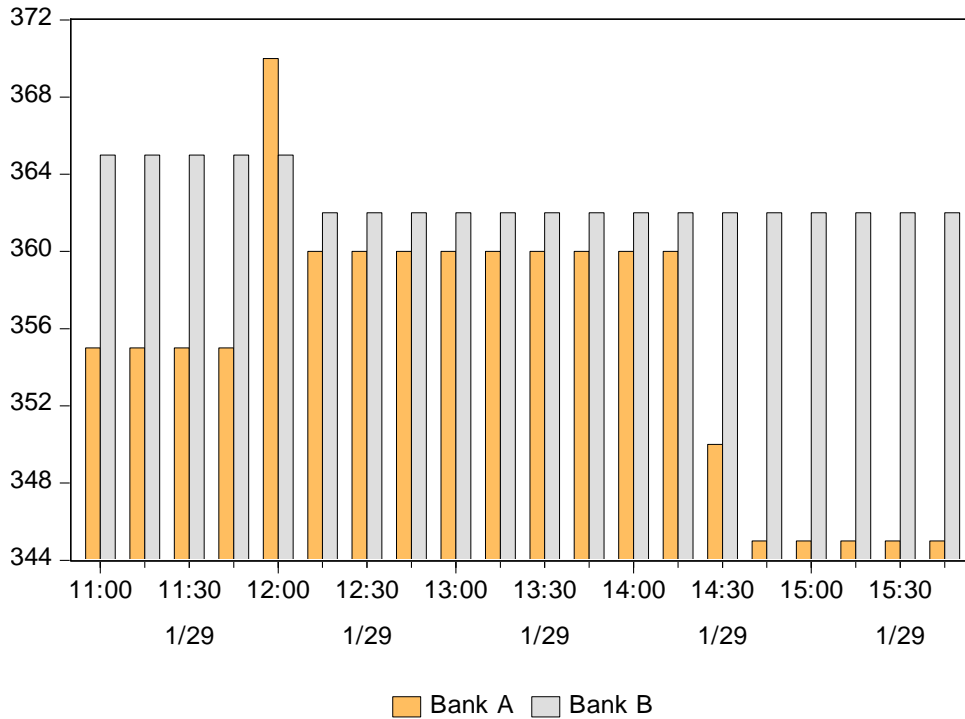


Chart 5b. Interest rate quoted by two NIBOR panel banks, 29 January 2009 11.00 –16.00. Three-month maturity. Percent

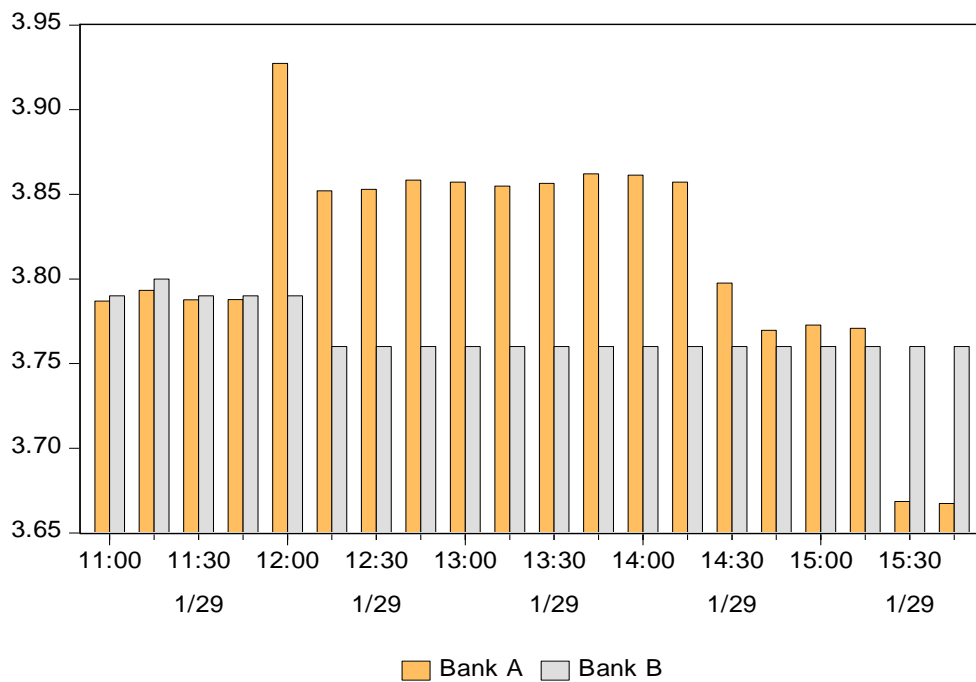


Chart 5a shows that Bank A increased its ask price for the forward premium considerably in the last 15 minutes before 12 noon.⁷ Chart 5b shows that this affected the interest rate contribution to NIBOR. This rate rose markedly from 3.78 percent to 3.93 percent. In the course of the first 15 minutes after the NIBOR fixing at 12 noon, Bank A reduced its forward premium again, and the associated interest rate fell back to 3.85 percent. At the end of the day, both the forward premium and the interest rate were lower than immediately before the NIBOR fix at 12 noon. It is not evident how these movements can reflect general market conditions for NOK liquidity that day. It is even less so in view of the quotes from Bank B in the chart: in the last hour before 12 noon, Bank B has higher forward premium quotes than Bank A, but approximately the same interest rate. This means that Bank B based its quote on a lower USD rate than Bank A. Up to 12 noon, however, there are no changes in Bank B's forward premium quote or the interest rate submitted to NIBOR. On this basis, it is not evident how the marked increase in forward premium and interest rate quote by Bank A at 12 noon can reflect general market conditions. Banks can have varying liquidity needs at a given time, which can be reflected in forward premium quotes. It cannot be ruled out that Bank A had a higher need for liquidity at just around 12 noon, which also resulted in a higher NIBOR contribution, but from an outsider's perspective, the reason for these movements just before the NIBOR fixing is not apparent.

Charts 6a and 6b show another example, now from 2010. Chart 6a shows the contributions to NIBOR from all of the six panel banks over three days, between 11 and 13 August 2010. Chart 6b shows two of the banks' forward premium quotes between 11.00 and 13.45 on 12 August.

⁷ Bank A does not refer to the same bank in all the examples.

Chart 6a. Banks' contributions to NIBOR, 11–13 August 2010. Three-month maturity. Percent

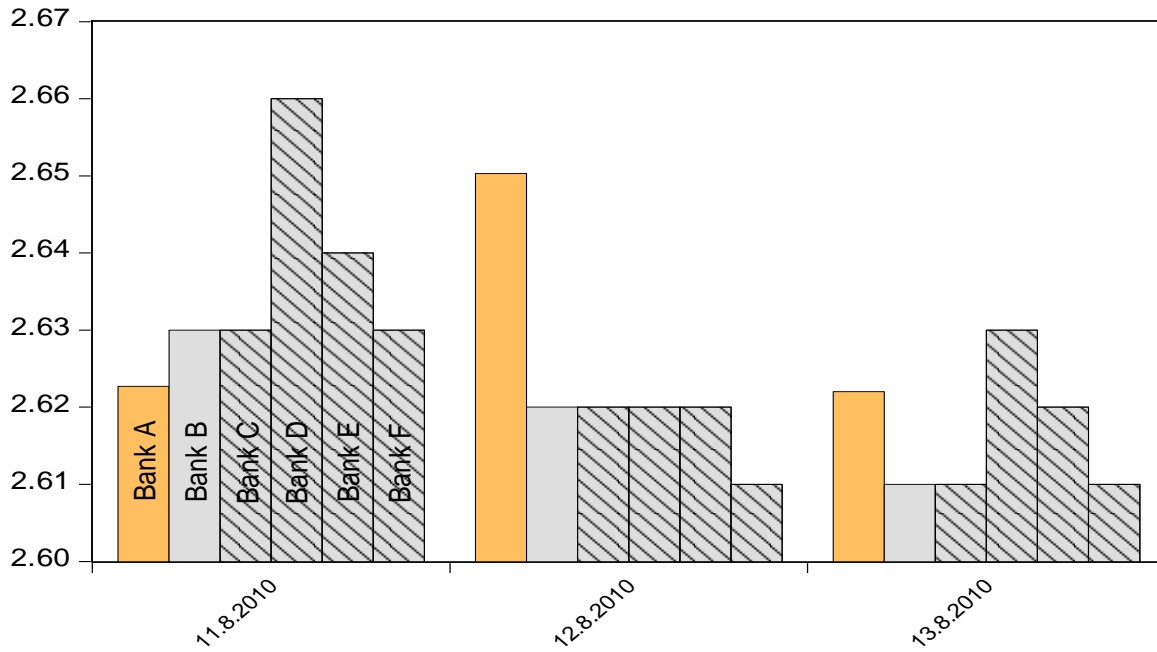


Chart 6b. Forward premiums quoted by NIBOR panel banks A and B, 12 August 2010 10.00 – 13.45. Three-month maturity. Forward points

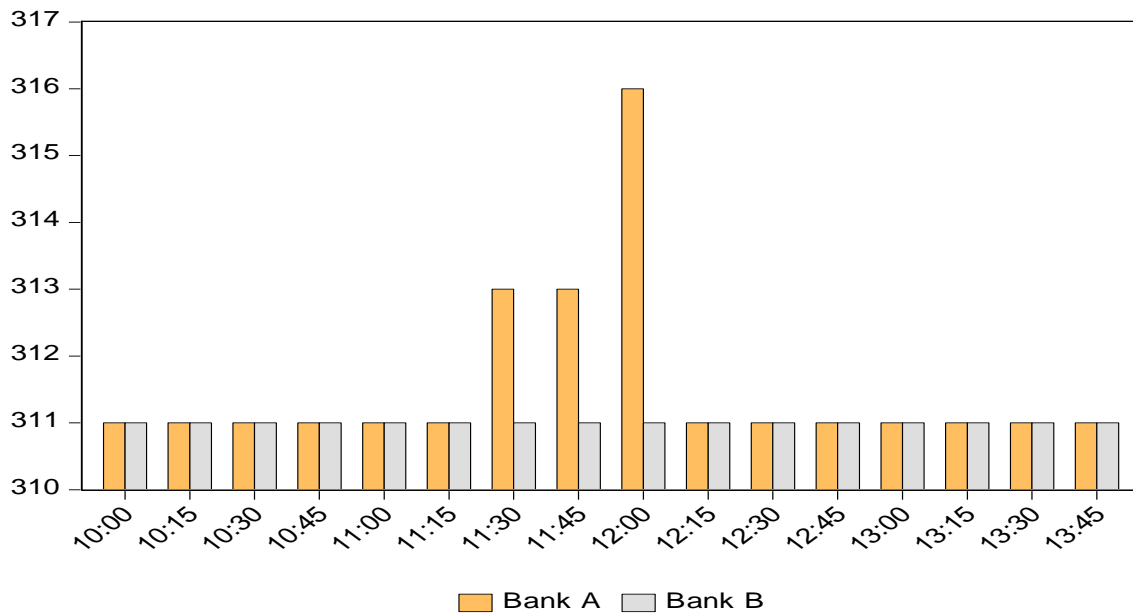


Chart 6a shows that Bank A adjusted its NIBOR contribution in the opposite direction from all the other banks between 11 and 12 August. After submitting the lowest rate on 11 August, Bank A submitted by far the highest the following day. Chart 6b shows that this coincided with an increase in Bank A's quoted forward premium in the last half hour before 12 noon on 12 August, which was then reversed shortly thereafter. Chart 6a shows that the following day, 13 August, Bank A's NIBOR submission was again in line with the other banks' submissions. This is another example where it is not clear how these movements could be the result of market developments. It is not apparent to non-panel market participants why Bank A's liquidity needs would be such as to imply a considerable increase in the ask price at 12 noon followed by a similarly substantial fall.

Charts 7a and 7b show an example from March 2011. Chart 7a shows five of the NIBOR panel banks' forward premium quotes at 12 noon over three days, from 1 to 3 March 2011.⁸ On 1 March, the banks' forward premium quotes were almost identical, as would be expected if all the quotes reflected demand conditions in the fx swap market. The following day, 2 March, four of the five banks increased their forward premium quotes, which may indicate a change in demand for NOK in the fx swap market. The last bank (Bank A), however, posted a quote for the forward premium in the opposite direction. Chart 7b shows that this influenced Bank A's contribution to NIBOR, which changed from being by far the highest on 1 March to being the lowest contribution on 2 March. On 3 March, the differences between the banks, in forward premiums and contributions to NIBOR, were again fairly small.

⁸ Data for the last bank's forward premium for these days in 2011 are not available, and the example therefore shows only five of the six NIBOR panel banks.

Chart 7a. NIBOR panel banks' quoted forward premiums at 12 noon, 1–3 March 2011. Three-month maturity. Forward points

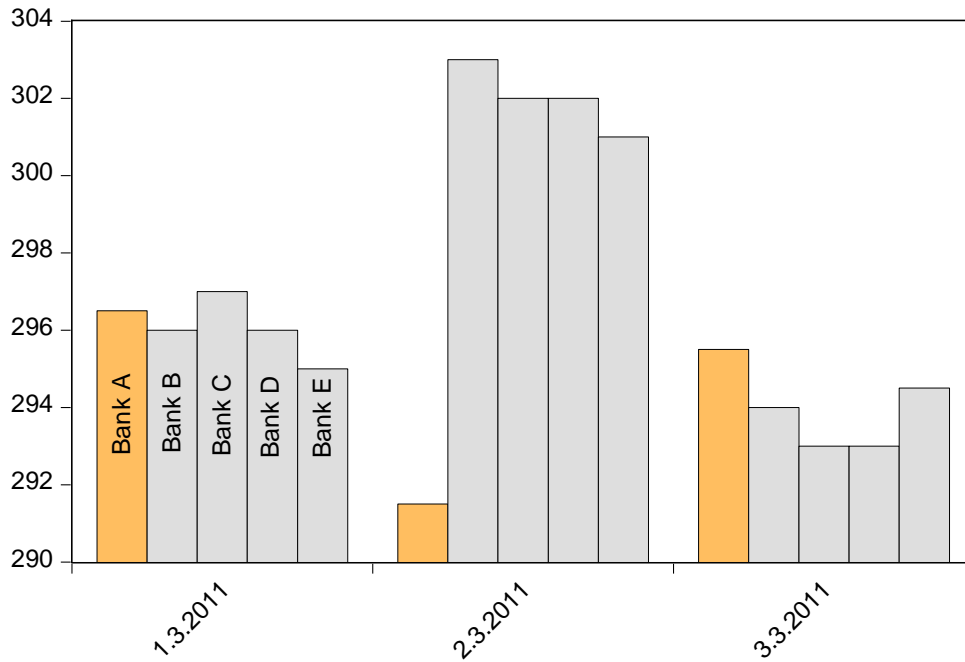
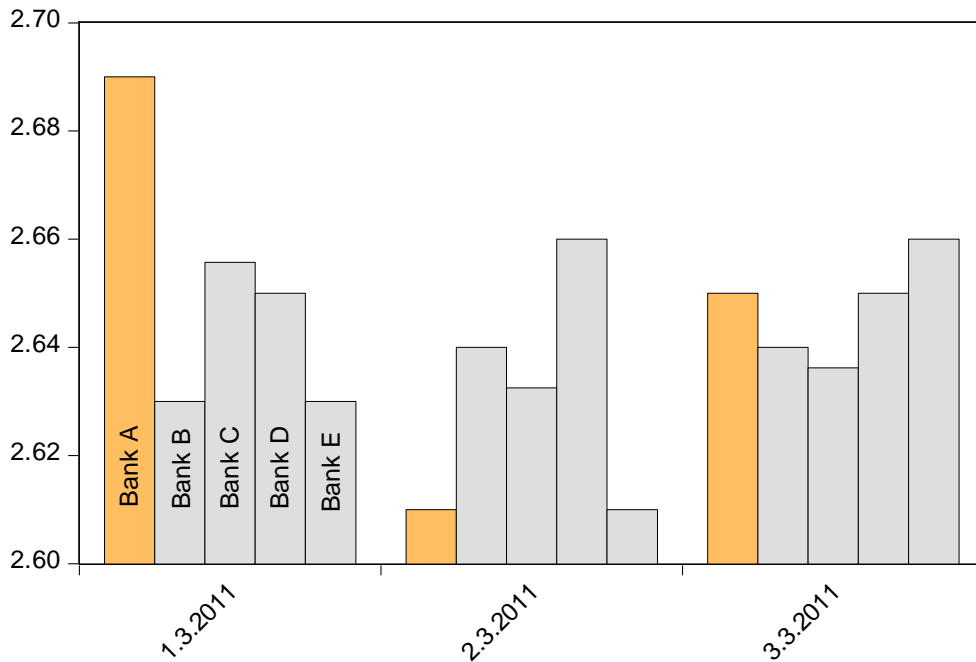


Chart 7b. Banks' NIBOR contributions (at 12 noon), 1–3 March 2011. Three-month maturity. Percent



As illustrated by these examples, NIBOR is not more closely aligned with the market than other benchmark rates as a result of its connection with the fx swap market. The wide spreads used by NIBOR panel banks provide substantial scope for deviation from actually traded prices in the fx swap market. As illustrated in the examples above, banks' individual forward premium quotes differ to such an extent in terms of both level and degree of change that they cannot all reflect demand conditions in the NOK market at the same time.

4. USD rates used as a basis for NIBOR

Before the financial crisis, USD LIBOR was used as a basis for the calculation of NIBOR. During the financial crisis, LIBOR apparently underestimated the USD rates European banks were facing. As a result, the NIBOR rate based on LIBOR and the forward premium for USD and NOK was unrealistically low. In autumn 2008 the NIBOR panel banks agreed to replace USD LIBOR with another USD rate and selected the rate published by the brokerage house Carl Kliem. This rate was considerably higher than LIBOR and was perceived as a more realistic rate. The Kliem rate is said to express the cost for European banks of borrowing USD through the interbank market. Kliem is very close to the rate obtained by swapping three-month EURIBOR for USD in the fx swap market.⁹

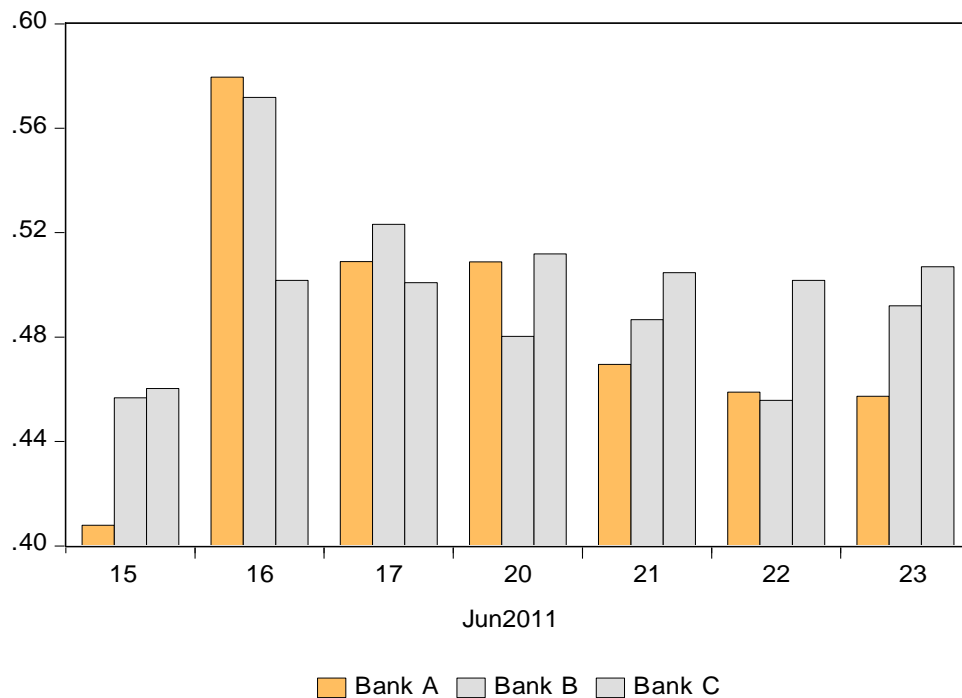
NIBOR panel banks do not apply the Kliem rate mechanically in their NIBOR quoting, but report that they also exercise judgement.¹⁰ The USD rate is in principle intended to reflect banks' marginal USD rate in the unsecured interbank market. It will vary over time and can frequently differ somewhat across banks.

Chart 8 shows a calculation of the USD rate applied by three NIBOR panel banks over a period of seven trading days in June 2011. Volatility in the USD market was relatively low in this period. The USD rates have been calculated residually based on banks' daily NIBOR and forward premium quotes

⁹ The use of Kliem as a basis for NIBOR raises questions related to the transmission of risk premiums from euro rates to Norwegian rates. See Norges Bank *Staff Memo* 21/2012 for more details.

¹⁰ The following has been included in an appendix to the NIBOR rules adopted by Finance Norway on 30 October 2013: "USD interest rates are to be determined on the basis of an assessment of a number of interest rates and benchmarks, possibly including currencies other than USD, so that NIBOR submissions as far as possible reflect the interest rates that a bank would charge for lending in NOK to a leading bank that is active in the Norwegian money and foreign exchange markets, as required by the rules."

Chart 8. USD rates applied by three NIBOR panel banks. 15–23 June 2011. Three-month maturity. Percent



As show in Chart 8, banks’ individual USD rates can fluctuate fairly randomly in relation to each other. In the course of these seven trading days in June 2011, the USD rate applied by Bank A was first by far the lowest, then the highest, then the lowest again a few days later. The lack of a consistent pattern is not unique to this period. It is frequently the case that the bank with the highest USD rate one day has the lowest a few days later. There is no obvious link between these relative movements and market conditions.

Chart 9a. USD rates applied by NIBOR panel banks, 15–17 August 2012. Three-month maturity. Percent

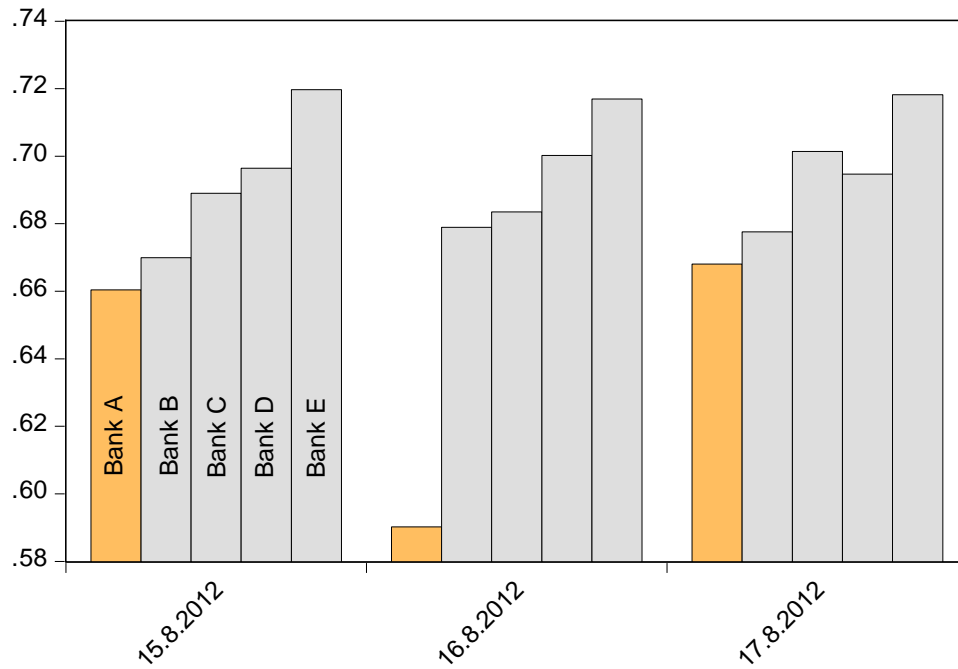
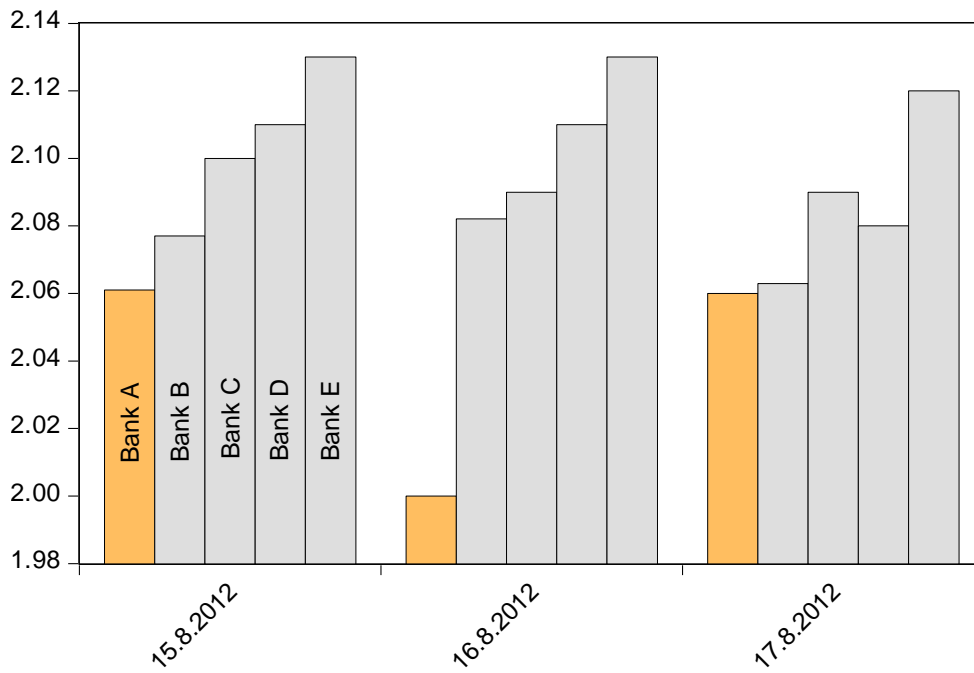


Chart 9b. Banks' NIBOR contributions, 15–17 August 2012. Three-month maturity. Percent



Charts 9a and 9b show an example from August 2012 of how changes in USD rates affected the contributions to NIBOR. Chart 9a shows the USD rate on which each bank's contribution to NIBOR was based between 15 and 17 August 2012. Direct data for these rates is not available, but they can be calculated based on data for the NIBOR contribution and forward premiums.¹¹ The Kliem rate was approximately unchanged over these three days, and all the NIBOR panel banks applied USD rates that were somewhat lower than Kliem. Between 15 and 16 August, Bank A reduced its USD rate by 6 basis points, while the other banks kept their USD rates unchanged. Between 16 and 17 August, Bank A increased its USD rate again by 6 basis points, while there were only minimal changes in the other banks' rates. Chart 9b shows that Bank A's change in its USD rate over these few days resulted in a directly corresponding change in Bank A's NIBOR contribution. Such short-term changes in a bank's USD rate, in the opposite direction from the Kliem rate and the other NIBOR panel banks' rates, raise doubts as to whether the swap construction results in a benchmark rate that is more closely aligned with the market than other countries' benchmark rates, which are based on panel banks' judgement.

5. Summary and conclusion

High-frequency data from Thomson Reuters provide an opportunity to study in detail how individual banks have determined their NIBOR contributions. The analysis shows that the individual panel banks' contributions to NIBOR vary considerably in relation to each other, without following any obvious pattern that can be explained by market conditions. The unsystematic variation around the average is considerably wider for NIBOR banks than for banks on the USD LIBOR panel. The data set contains many examples to show that individual panel banks have on some occasions adjusted their NIBOR contributions in the opposite direction from the other panel banks, by adjusting either the forward premium or the USD rate applied as a basis. In several cases, these adjustments have influenced the NIBOR fix that day. The underlying reasons for these changes are not apparent to non-panel market participants. Whatever the reason for these changes, non-panel participants' confidence in NIBOR as a benchmark rate may have been impaired as a result. Overall, Norges Bank finds that the data strengthen the arguments in favour of discarding the construction of NIBOR as an fx swap rate.

¹¹ As data for one of the NIBOR panel banks' forward premiums are currently not available, the USD rate for this bank cannot be calculated. The left-hand panel in the chart therefore includes only five of the six banks.