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## Research Report

# The turbulence in the Norwegian money market in autumn 2022

Staff Memo, No. 15/2023

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# STAFF MEMO

## The turbulence in the Norwegian money market in autumn 2022

NO. 15 | 2023

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JOAKIM JOHNSEN  
PETTERSEN AND  
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NORGES BANK

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# The turbulence in the Norwegian money market in autumn 2022

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THE TURBULENCE IN THE  
NORWEGIAN MONEY MARKET  
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Inga-Malene Huse, Joakim Johnsen Pettersen and Ingebjørg Hansen Sævareid<sup>1</sup>

*Record-high payments of petroleum tax in October 2022, and the accompanying fall in structural liquidity, resulted in a marked rise in the shortest-term Norwegian money market rates. In this staff memo we describe how petroleum tax payments affect liquidity in the banking system and discuss why money market rates increased considerably, even though Norges Bank offered a number of F-loans to banks. Data from Norges Bank's money market reporting (RPD) show that it was foreign banks lacking access to Norges Bank's market operations that borrowed NOK at very high interest rates in the FX swap market. Regulatory requirements and internal guidelines relating to liquidity and capital adequacy limited the amount banks could borrow from Norges Bank and constituted an important factor behind the rise in money market rates.*

## 1. Introduction

At the beginning of October 2022, the price of borrowing NOK at short maturities in the Norwegian money market rose to extreme levels. At their highest, the shortest money market rates, which are derived from prices in the FX swap market, were almost 60 percentage points above the policy rate. The rise in premiums above the policy rate spread to longer-term money market rates, and money market premiums remained at high levels throughout much of October 2022.

The reason for the rise in money market rates was a record-high payment of petroleum tax, which led to a sharp fall in liquidity in the banking system. As a result, the price of borrowing NOK in the FX swap market rose. Very high oil and gas prices in 2022 resulted in historically high revenues in the petroleum sector and tax payments to the state, and payments in October proved particularly high.

When liquidity in the banking system sinks below Norges Bank's target, Norges Bank supplies liquidity to banks through F-loans. The loans are granted against collateral in securities. On the petroleum tax due date in October, liquidity fell below the target, and Norges Bank supplied liquidity through ordinary F-loans. As a response to money market rate fluctuations, Norges Bank also offered liquidity through extraordinary F-

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<sup>1</sup> We would like to thank Martin Bjørlo, Knut Kolvig and Kjetil Stiansen for useful comments and input.

loans. In contrast to ordinary F-loans, banks were permitted to borrow unlimited volumes in the form of extraordinary F-loans at a fixed premium above the policy rate. Despite this, it took time for money market premiums to decline to more ordinary levels.

This paper describes how higher oil and gas prices affected liquidity in the banking system, the impact this had on Norwegian money market rates and Norges Bank's response. Finally, reasons behind the pronounced fluctuations in the money market are discussed. Section 2 explains the relationship between petroleum tax and structural liquidity. Section 3 describes developments in Norwegian money market rates around the petroleum tax payment in October 2022. Section 4 discusses why foreign market participants demanded substantial amounts of NOK during the period and why bid volumes for Norges Bank's F-loans were low. Section 5 summarises.

## 2. The effect of petroleum tax on structural liquidity

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### 2.1. The petroleum fund mechanism

When oil companies pay taxes to the government, structural liquidity in the banking system falls. Structural liquidity refers to banks' deposits in Norges Bank prior to Norges Bank's market operations. Payments to and from the government, which has its account with Norges Bank, constitutes the main factor behind fluctuations in structural liquidity. Norges Bank aims to maintain liquidity in the banking system at close to NOK 35 billion. Norges Bank uses market operations to maintain liquidity in the banking system around the target at the end of the day. This is done to ensure that the shortest market rates are close to the policy rate, so that the policy rate passes through to other rates in the economy.

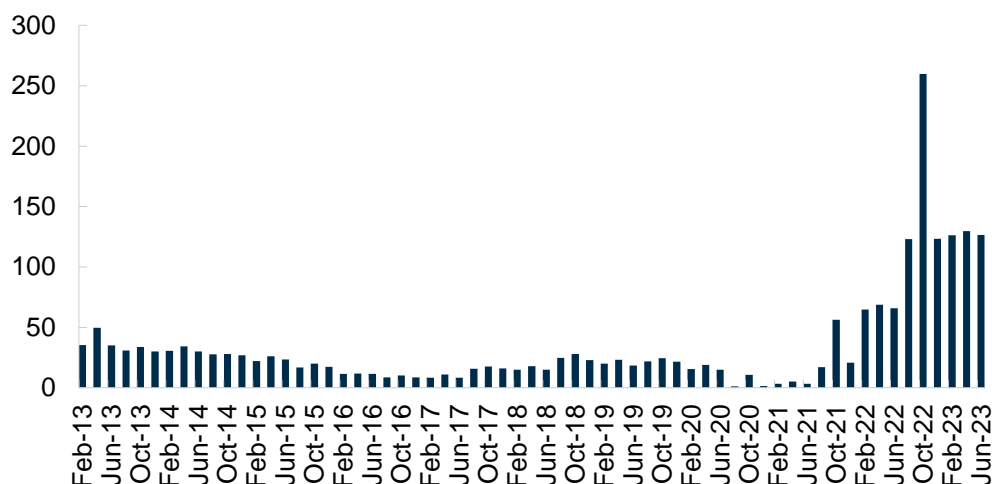
Over time, the amount of NOK withdrawn from the banking system when the government receives petroleum revenues in NOK will be transferred back to the banking system. In the circumstances as of 2023, where NOK revenues from petroleum activities exceed the non-oil fiscal deficit, the amount of NOK is transferred back to the banking system through spending over the government budget and through Norges Bank's foreign exchange transactions on behalf of the government. Norges Bank sells NOK equivalent to the difference between government revenues from the petroleum sector and the non-oil fiscal deficit. In this manner, the so-called petroleum fund mechanism is liquidity neutral over time.

Even though the petroleum fund mechanism is liquidity-neutral over time, the payment of petroleum tax can have a substantial temporary effect on liquidity in the banking system. This is because oil companies pay tax in six instalments a year, while government spending and Norges Bank's foreign exchange transactions are spread out over time. When large amounts of petroleum tax fall due, structural liquidity may reach very low levels. As a result of high oil and gas revenues in recent years, amounts of petroleum tax due have become extraordinarily large (Chart 1). This has led to a correspondingly large fall in structural liquidity on payment dates.

Fluctuations in structural liquidity can produce a considerable effect on money market premiums even though Norges Bank always supplies liquidity up to target at the end of the day. To increase their own liquidity predictability, banks often borrow NOK at long maturities in the FX swap

market prior to a drop in structural liquidity. Low structural liquidity therefore leads to higher demand for NOK in the FX swap market.<sup>2</sup>

*Chart 1: Payment of petroleum tax on due date. February 2013 – June 2023. NOK billion*



Source: Norges Bank

## 2.2. Uncertainty regarding the amount of petroleum tax due in October 2022

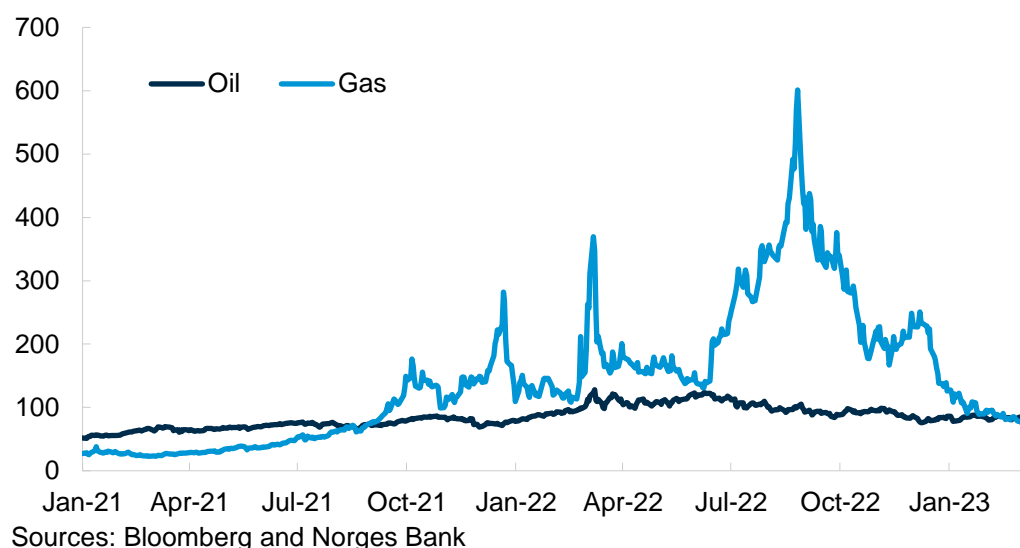
Oil companies' instalment tax is determined in June each year based on information from the companies on expected results for the relevant income year. Instalment tax is payable over six instalments, 1 August, 1 October and 1 December of the income year and 1 February, 1 April and 1 June of the following year, respectively. In principle, therefore, the amount of instalment tax is known well in advance of the due date. However, on the due dates in October and April, oil companies have the opportunity to pay in more than the stipulated instalment amount. They will do so if they believe their income will be greater than that which the stipulated instalment amount accounts for, so that they avoid having to pay arrears.

As a result of the sharp rise in European gas prices through summer 2022 (Chart 2), oil companies were expected to pay more tax than the stipulated instalment amount in October. The stipulated instalment amount was NOK 123.1 billion, while the size of the extra payment was highly uncertain. This contributed to increased unpredictability related to

<sup>2</sup> For further details on the relationship between structural liquidity and money market premiums see Hagen, M. and Stiansen, K. (2023), «[Does structural liquidity have a greater impact on the premium in NIBOR than earlier?](#)», Staff Memo 14/2023, Norges Bank.

the liquidity situation in the banking system around the petroleum tax due date on 3 October.

*Chart 2: Oil and gas prices. 1 January 2021 – 10 March 2023. US dollars/oil equivalents.*



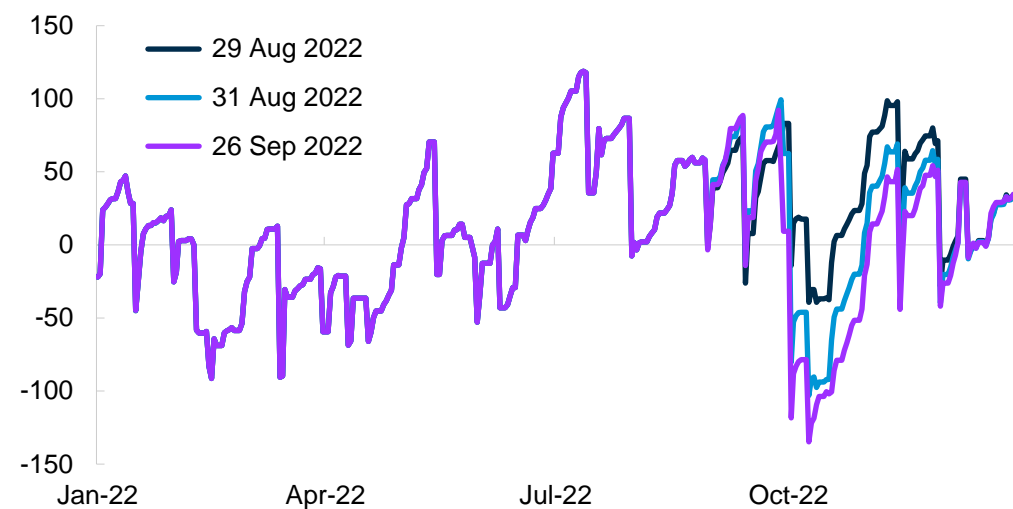
Norges Bank makes structural liquidity forecasts as part of its liquidity management. Norges Bank revised upward its estimate of the petroleum tax amount several times ahead of the due date (Chart 3). After first assuming the stipulated instalment amount of NOK 123.1 billion in the structural liquidity forecast, the estimate was revised upward by NOK 100 billion to NOK 223.1 billion in the forecast published on Norges Bank's website on 31 August. The forecast was revised up again in the forecast published on 26 September. At this time, Norges Bank assumed that the amount of petroleum tax would be NOK 258.3 billion. As a result of the upward adjustments, the forecast for structural liquidity at the beginning of October fell from around NOK -15 billion to around NOK -120 billion. The downward adjustment of the structural liquidity forecast was smaller than the upward adjustment of the amount of petroleum tax due owing to alterations in other forecast variables.



Chart 3: Norges Bank's structural liquidity forecast. 1 January 2022 – 31 December 2022. In billions of NOK

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Source: Norges Bank

### 3. What happened to money market rates around the petroleum tax due date?

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On Friday 30 September, the last business day before the petroleum tax due date, the price of obtaining NOK in the very short segment of the FX swap market rose sharply.<sup>3</sup> The interest rate on swapping USD into NOK with settlement the next business day and maturity the following business day (tomorrow/next (T/N)) rose to more than seven percent, more than five percentage points above the policy rate. Normally, this interest rate is close to the policy rate. On the due date of 3 October, the T/N rate rose further, to around 25 percentage points above the policy rate (Chart 4) but traded at even higher rates during the day.

The turbulence in the very short end for NOK FX swaps spread to FX swaps with longer maturities and to other NOK money market rates. Since the Norwegian money market rate Nibor is derived from a USD rate and the price of exchanging USD for NOK in the FX swap market, the turbulence in the FX swap market influenced Nibor at different tenors. The premium above the expected policy rate in one-week Nibor rose by just under 2 percentage points from 29 September to 3 October, while the premium in three-month Nibor rose by 0.15 percentage points in the same period. In the weeks prior to the due date, there were no clear indications of the coming turbulence in the FX swap market, apart from a slight increase in the premium in three-month Nibor, as is habitually the case prior to sharp declines in structural liquidity.

When liquidity in the banking system falls below Norges Bank's target, Norges Bank supplies liquidity to the banking system through F-loans. In the event of particularly large falls in structural liquidity, such as on petroleum tax due dates, Norges Bank offers pre-announced F-loans with auction date two days before the settlement date. Such so-called T+2 F-loans are offered to contribute to greater predictability concerning the banking system liquidity in the event of large decreases in structural liquidity. Norges Bank offered banks a number of F-loans as part of

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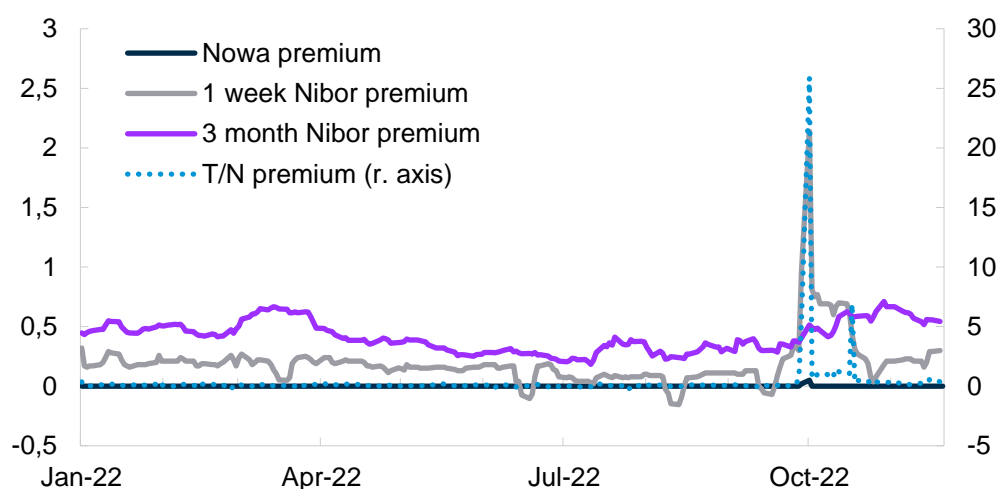
<sup>3</sup> In an FX swap agreement two parties agree to exchange currency for a given period. Counterparties exchange currencies today at the prevailing spot exchange rate in the FX market and agree to re-exchange at an agreed rate at a future date. This forward rate is called the forward exchange rate and the difference between the spot rate and the forward rate is called forward points. Forward points normally largely reflect the interest rate differential between the two currencies. In periods, however, fluctuations may occur in the relative demand for the currencies causing the forward points to deviate from the interest rate differential.

ordinary liquidity management on the petroleum tax due date in October, two of which had deferred settlement.

In response to the extreme premiums in short money market rates around the petroleum tax due date, Norges Bank also offered daily F-loans with overnight maturities and full allotment in addition to ordinary market operations. The extraordinary F-loans were announced on October 3, and the interest rate on these loans was equal to the policy rate plus 10 basis points. The auctions were conducted at the end of the day, and liquidity above the target resulting from injections through these loans was not withdrawn in the form of F-deposits. The daily loans assured banks that they could meet their NOK needs with F-loans at the end of the day. This made it easier for banks to lend NOK in the FX swap market, which could contribute to reducing premiums in the shortest money market rates.

During the afternoon of 3 October, signs appeared that the money market turbulence was receding. The forward points between NOK and USD in the very short segment of the FX swap market and short NOK rates derived from the FX swap market fell sharply. The NOK interest rates derived from the shortest part of the FX swap market nevertheless were well above the policy rate and remained at higher-than-normal levels for a couple of weeks after this (Chart 3). Norges Bank therefore extended the offer of daily F-loans with full allotment for another two weeks on 13 October.

*Chart 4: Estimated premium on the expected policy rate for borrowing NOK in the money market. 3 January 2022 – 21 November 2022. Percentage points*



Sources: Bloomberg and Norges Bank

## 4. Why were money market rates so volatile?

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### 4.1. Foreign market participants borrowed substantial volumes of NOK

Norges Bank's money market data (RPD) can shed light on who borrowed NOK in FX swaps in the days around the petroleum tax due date. Since 2019, Norwegian banks and branches of foreign banks with accounts with Norges Bank have reported their money market transactions to Norges Bank's Money Market Reporting.<sup>4</sup> The RPD data reveal that the reporting banks lent substantial amounts of NOK to foreign counterparties in FX swaps with overnight (O/N) and tomorrow/next (T/N) maturities in the days around the petroleum tax due date (Chart 5). The vast majority of these transactions were with foreign banks. On Monday, 3 October, the reporting banks lent NOK 63 billion at O/N and NOK 73 billion at T/N to foreign counterparties. This is the highest combined turnover for these two one-day maturities since the reporting of money market data began.

Foreign market participants do not hold accounts with Norges Bank and therefore cannot participate in Norges Bank's market operations. Therefore, they cannot take out F-loans to obtain NOK liquidity. Foreign banks must instead meet their NOK needs in the money market, for example by swapping into NOK in the FX swap market, as they did on a large scale in October 2022. This makes them more vulnerable to abrupt falls in liquidity in the Norwegian money market than banks holding accounts with Norges Bank. Under such market conditions, they are dependent on banks with access to Norges Bank's market operations taking up F-loans and then relending NOK in the money market.

Chart 6 shows the estimated premiums above the policy rate for the reporting banks' trades with FX swap market participants at short maturities around the petroleum tax due date. Up to the last days of September, premiums were close to zero. On 29 September, premiums began to increase, before rising considerably throughout the day on September 30. They declined again somewhat when Norges Bank announced an F-loan at around lunchtime on 30 September but rose again throughout the day. On the due date of 3 October, overnight

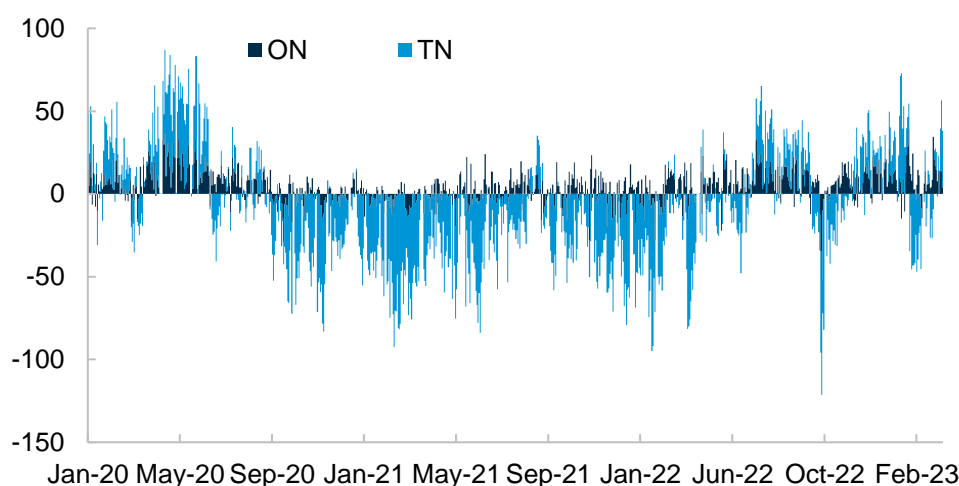
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<sup>4</sup> The largest banks (groups A1 and A2 in Norges Bank's settlement system) report on a daily basis at transaction level, while smaller banks report annually and on an aggregated basis.

trades were made between NOK and USD at NOK interest rates close to 60 percentage points above the policy rate. In the afternoon, premiums fell rapidly, and the decrease continued the following day. However, it took some time before they reached normal levels again.

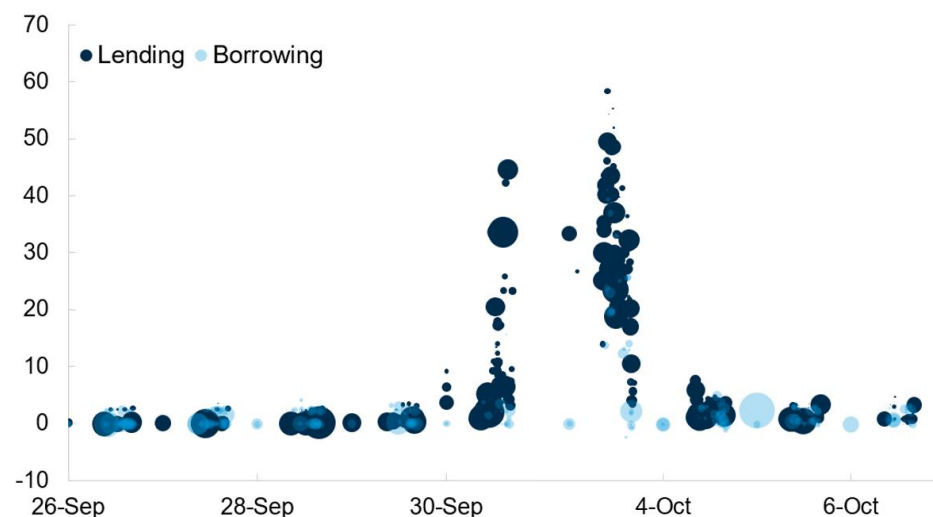
The foreign banks Norges Bank has contacted report that a substantial share of their NOK borrowing during the market stress period was on behalf of their customers. A handful of large international banks borrowed significant amounts, while a number of other foreign banks borrowed smaller amounts. At the same time, very few foreign counterparties lent NOK to the reporting banks around the tax due date.

*Chart 5: Reporting banks' net borrowing of NOK in FX swaps with foreign counterparties. Turnover by maturity. In billions of NOK*



Source: Norges Bank's reporting of money market data (RPD)

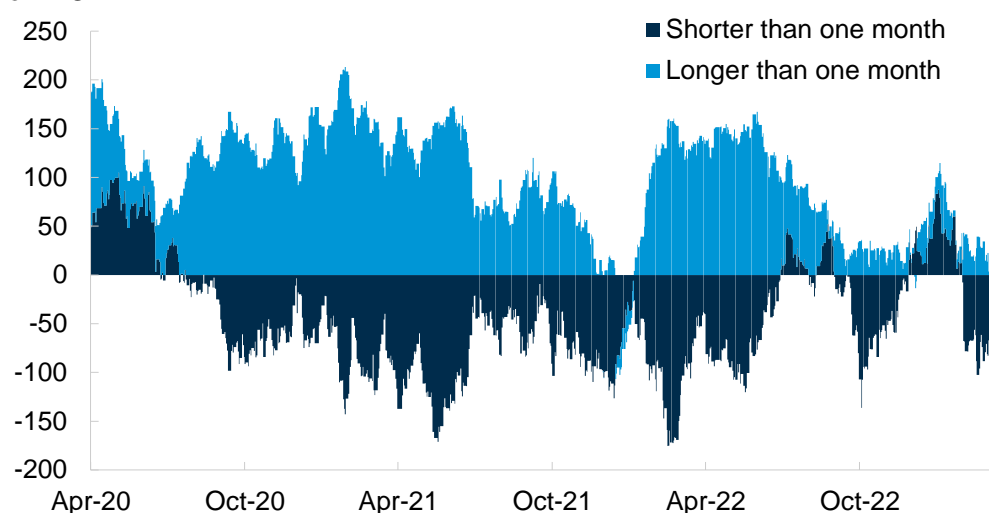
*Chart 6: Reporting banks' borrowing and lending of NOK to foreign counterparties in O/N and T/N FX swaps around the petroleum tax due date. Estimated premium above the policy rate in percentage points. Bubble size illustrates transaction volume.*



Source: Norges Bank's reporting of money market data (RPD)

Maturity transformation constitutes most of foreign banks' activity in the NOK FX swap market. They lend NOK at one maturity, financed by borrowing NOK at another (often shorter) maturity. Foreign banks' demand for NOK at short maturities therefore often stems from the fact that they have lent NOK with long maturities. This maturity transformation, whether on the bank's own account or on behalf of customers, is therefore normally reflected in foreign banks' borrowing significantly at short maturities from reporting banks in periods when they have lent the same banks substantial volumes of NOK at long maturities (Chart 7).

*Chart 7: Reporting banks' net borrowing of NOK from foreign counterparties in FX swaps. Outstanding amount by maturity. In billions of NOK*



Source: Norges Bank's reporting of money market data (RPD)

Chart 7 shows that reporting banks' net borrowing of NOK from foreign counterparties at long maturities was fairly low at the beginning of October 2022. As a result, Norges Bank's money market data provided little indication that foreign banks would have a considerable need to borrow NOK at short maturities to cover loans at long maturities around the petroleum tax due date.

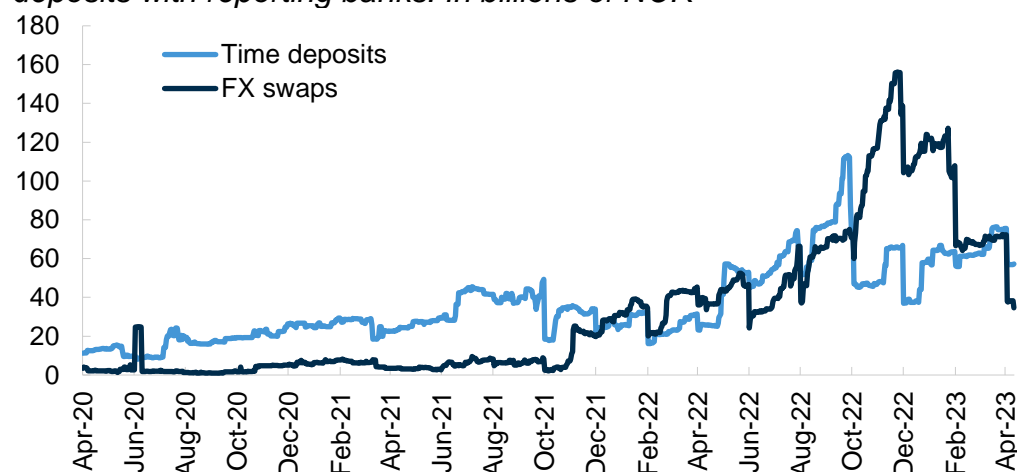
## 4.2. Oil companies invest a sizeable amount of NOK in the money market

One potential reason for foreign banks' substantial NOK borrowing from the reporting banks around the petroleum tax due date is that oil companies may have invested NOK with foreign banks prior to paying petroleum tax (Box 1). If the market participants who received NOK from oil companies used this NOK to fund loans at longer maturities to other customers, they may have faced a sudden requirement to replace this funding when the oil companies' investments matured. It is

conceivable that foreign banks were not able to fully gauge how much liquidity they would lose. Owing to oil companies' money market investments, petroleum tax payments have a greater impact on foreign banks than other declines in structural liquidity. There is probably less lending of NOK to foreign banks prior to other payments to the government, such as value added tax, withholding tax and employer's national insurance contributions.

Money market data indicate that some of the oil companies' time deposits and FX swaps matured prior to the due date for petroleum tax. Chart 8 shows oil companies' placements of NOK in time deposits and through FX swaps with the banks that report to RPD. Just prior to the due date in October, oil companies had NOK 187 billion in outstanding lending to the reporting banks, broken down between NOK 77 billion in FX swaps and NOK 110 billion in time deposits. After the tax due date, the amount outstanding was reduced by NOK 82 billion. The fall in outstanding time deposits and FX swaps with the reporting banks in the RPD is thus around NOK 170 billion lower than the amount of petroleum tax. The oil companies had probably invested parts of this NOK 170 billion in FX swaps and time deposits with foreign banks that do not report to RPD. Figures from EMIR<sup>5</sup> indicate that a further NOK 25 billion in FX swaps and FX forwards concluded between oil companies and foreign banks matured. Figures from RPD and EMIR cover the allocation of just under half of the petroleum tax amount paid, but do not provide a complete overview of oil companies' NOK investments.

*Chart 8: Oil companies' NOK investments in FX swaps and time deposits with reporting banks. In billions of NOK*



Source: Norges Bank's reporting of money market data (RPD)

<sup>5</sup> European companies are required under the European Market Infrastructure Regulation (EMIR) to report transactions in OTC derivatives to central transaction repositories. These data are available to the supervisory authorities.

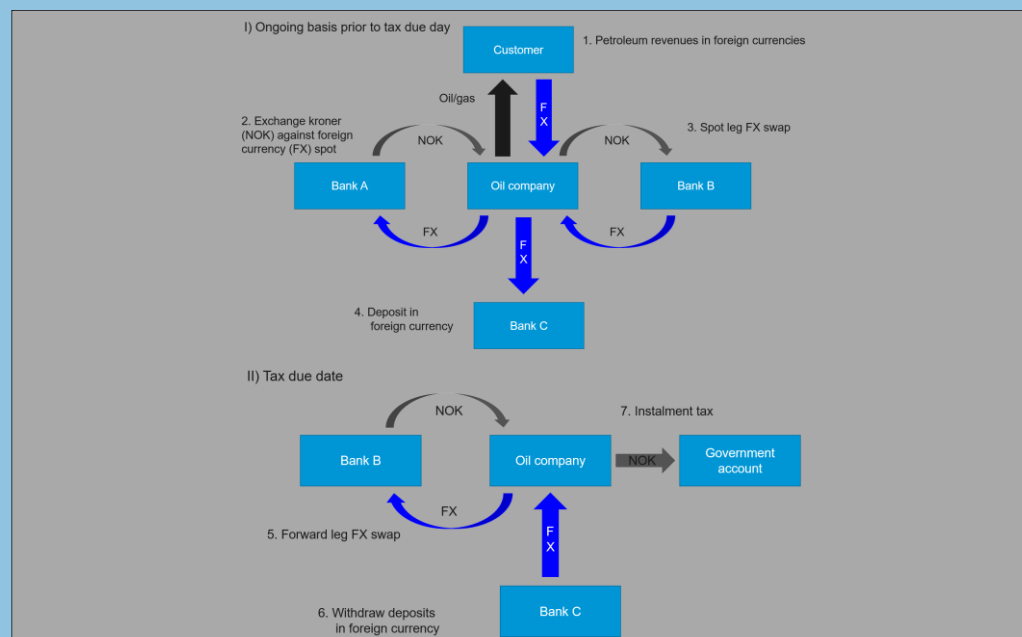
## Box 1: Oil companies' use of FX swaps prior to the tax due date

Oil companies invest substantial amounts in the money market in the period leading up to the petroleum tax due date. Oil companies' lending to the reporting banks through FX swaps and unsecured time deposits builds up before the tax due date and drops markedly just before the due date. Oil companies pay tax in NOK, and the taxation of oil revenues assumes a norm price for oil. The norm price is set daily based on oil prices in USD terms and the exchange rate between NOK and USD. In order to reduce the exchange rate risk associated with the taxation of revenues, oil companies tend to convert portions of their foreign currency revenues into NOK on an ongoing basis. Oil companies therefore have a need to invest NOK in the money market in the period ahead of the petroleum tax due date. For example, they can do this using time deposits in banks and by lending NOK in the FX swap market and investing in foreign currency. Periodically, oil companies are therefore an important provider of NOK liquidity in the money market. When petroleum tax falls due and FX swaps and time deposits mature, some of this supply of NOK vanishes. The chart below illustrates how oil companies can use the FX swap market for NOK in their liquidity management ahead of petroleum tax due dates.

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**Chart 9: Oil companies' use of FX swaps in the period to tax due date**





### 4.3. Low bid volumes at Norges Bank's F-auctions

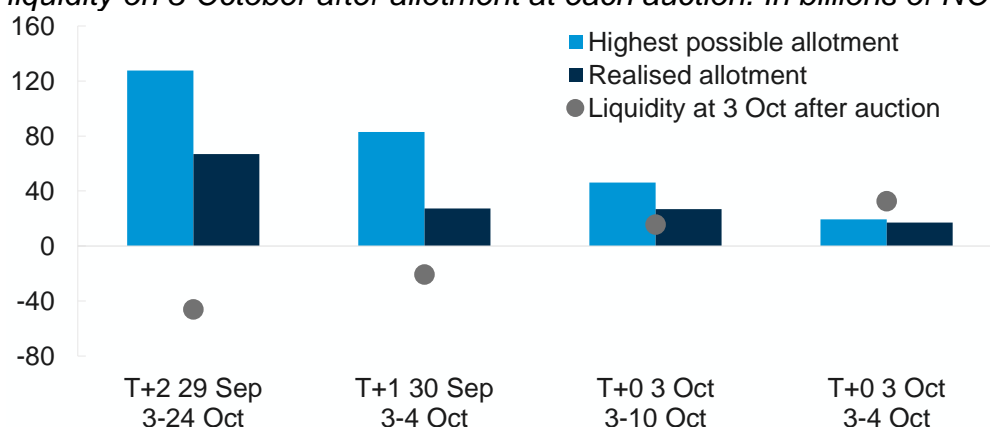
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Despite the fact that Norges Bank offered a number of F-loans in the period around the petroleum tax due date in October, money market rates took time to normalise. Banks with access to Norges Bank's facilities had very ample access to F-loans, but bid volumes were low. In light of the substantially high NOK rates in the FX swap market, it is surprising that banks did not bid up the interest rates and volumes for ordinary F-loans and did not use the extraordinary F-loans either. Banks could have borrowed as much NOK as they wished in the form of daily F-loans and lent short-term in the FX swap market at up to 60 percentage points higher interest rates. This indicates that banks were unable or unwilling to make greater use of price arbitrage than they did.

Overall, bid volumes for Norges Bank's ordinary F-loans during the market stress period were lower than Norges Bank could have allotted based on the target (Chart 10). At the same time, banks made very little use of the extraordinary loans. Moreover, only a small number of banks bid for large volumes of F-loans (Chart 11). However, it is not unique to this period that a small number of banks take most of the volumes at the F-loan auctions. For the T+2 F-loan with settlement on 3 October and maturing on 24 October, banks submitted a total bid volume of NOK 66.9 billion. According to the structural liquidity forecast, however, Norges Bank could have allotted as much as NOK 120 billion. For the F-loan with settlement on October 3 and maturing on 4 October, which was announced on 30 September, banks bid NOK 55 billion less than the maximum amount Norges Bank could have allotted to bring total liquidity up to target. The allotment of the ordinary F-loans with one-day and one-week maturities, which were announced on Monday 3 October and with same-day settlement, finally brought total liquidity on 3 October above the lower bound of the target range for liquidity management.

*Chart 10: Actual allotment and maximum allotment according to the liquidity forecast for F-loan auctions with settlement on 3 October, and liquidity on 3 October after allotment at each auction. In billions of NOK*

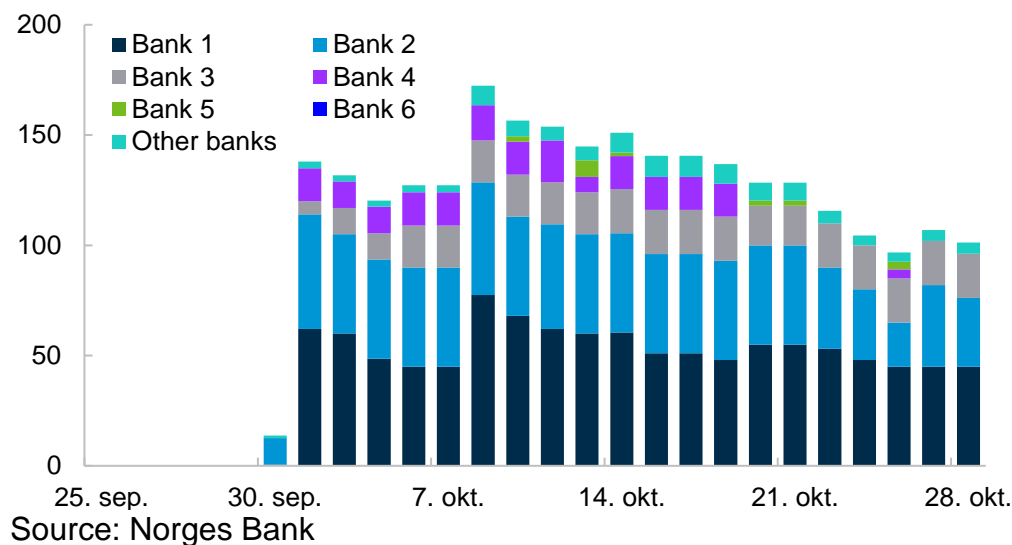


Source: Norges Bank

Chart 11: Nibor banks and other banks' borrowing in the form of F-loans in October 2022. Outstanding volume. In billions of NOK

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#### 4.4. Reasons why banks did not bid more at F-loan auctions

Following the market turbulence, the banks that are most active in the Norwegian money market offer different explanations as to why they did not take out more F-loans to relend in the market. According to the banks, the most important reasons were a lack of collateral for F-loans, as well as regulatory requirements and internal guidelines related to liquidity and capital.

##### 4.4.1. Collateral for loans from Norges Bank and regulatory liquidity coverage requirements

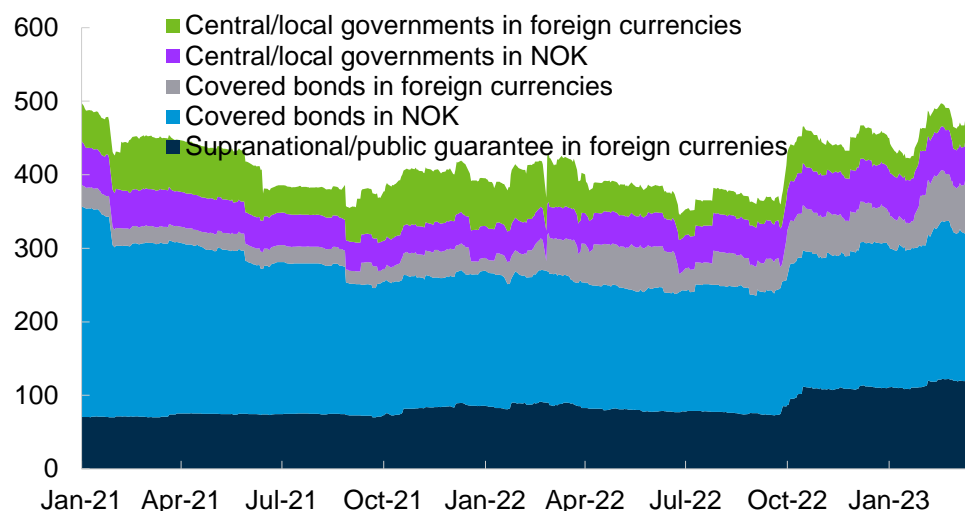
Norges Bank requires adequate collateral for loans, both for banks' intraday loans and for F-loans. Norges Bank accepts a broad range of collateral in a number of currencies. Most of the banks' collateral comprises covered bonds, government bonds and bonds issued by supranational authorities and development banks. Chart 12 shows the securities banks pledge as collateral.<sup>6</sup>

<sup>6</sup> Banks can borrow interest-free intraday against collateral. The purpose is to ensure that interbank payment settlements function satisfactorily.

*Chart 12: Banks' collateral pledged with Norges Bank. Borrowing capacity in billions of NOK*

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Source: Norges Bank

In isolation, banks' collateral pledged with Norges Bank suggests that they could have borrowed twice as much in Norges Bank's F-loans than they actually did. The after-haircut market value of the securities the banks had pledged with Norges Bank, i.e. the amount banks were allowed to borrow, was about NOK 360 billion at the end of September 2022. The bottom point for structural liquidity in October 2022 was minus NOK 150 billion, about NOK 185 billion lower than the target for total liquidity. The amount banks were allowed to borrow was thus considerably higher than amount of F-loans taken out in the period.

Despite the fact that banks had substantial collateral pledged with Norges Bank, some banks point to a lack of collateral as a limitation on taking out F-loans. One explanation for this is that banks use the same collateral to meet regulatory liquidity coverage requirements, the "liquidity coverage ratio" (LCR). Financial institutions with LCR requirements must hold sufficient high-quality liquid assets (HQLA) to cover net liquidity outflows for 30 days in a hypothetical stress situation. In the calculation of HQLA, banks may not include encumbered securities. As a result, the amount banks are allowed to borrow from Norges Bank may appear to be higher than they are in practice if they are to satisfy the LCR requirements.

Banks have specific LCR requirements for currencies that account for more than five percent of their total liabilities, as well as LCR requirements for all currencies combined. Norwegian banks with EUR and/or USD as a significant portion of their liabilities must meet a 100 percent LCR in EUR and USD and overall, but only 50 percent in NOK. Other Norwegian banks must satisfy a 100 percent LCR in NOK.

Norwegian branches of Nordic banks are often either subject to similar LCR requirements in NOK by their home state supervisory authorities or have internal liquidity requirements similar to the LCR. In addition, banks often prefer to have a safety margin for their liquidity coverage above the stipulated LCR requirement. If banks' LCR coverage in NOK is close to the minimum level set by the supervisory authorities or is close to internal requirements, further encumbrance of securities for F-loans may result in coverage falling below the minimum level. See Appendix 1 for numerical examples of how a fall in structural liquidity, F-loans and NOK lending in FX swaps affect banks' LCR.

Banks have not pledged all their liquid assets in favour of Norges Bank, but they can transfer additional collateral if necessary. This also applies to securities that are not already on Norges Bank's list of approved securities and fund units, provided that the securities satisfy Norges Bank's collateral requirements. However, how swiftly banks can increase the amount of collateral can vary according to market conditions and may differ from one bank to another. For example, in certain periods, it can prove costly to obtain securities in the market, or it may take time to transfer securities internally within banks. Between 28 September and 5 October, the amount banks were allowed to borrow rose by just under NOK 75 billion, of which securities in NOK represented less than 25 percent. The small increase in pledges of NOK collateral is probably related to the fact that encumbering NOK securities in connection with taking out F-loans may have an adverse impact on banks' liquidity coverage in NOK (Appendix 1). The increase occurred gradually and may indicate that banks needed some time to obtain securities that they could pledge as collateral with Norges Bank. A number of market participants Norges Bank has been in contact with during and after the market turbulence point to such challenges. The fact that banks required time to increase their capacity to borrow from Norges Bank probably contributed somewhat to the market turbulence.

#### **4.4.2. Regulatory leverage ratio requirement**

Banks must also meet a number of regulatory capital requirements intended to strengthen banks' loss-absorbing capacity. This type of regulatory requirement may limit banks' ability to take out F-loans as well. Among other things, banks are subject to a leverage ratio requirement. This entails that banks' Tier 1 capital must exceed a minimum share of banks' exposures before risk weighting. The minimum requirement is 3 percent, but several banks are subject to higher requirements.

Banks' leverage ratios do not decline when they replace a loss of reserves with F-loans. The leverage ratio requirement for capital

adequacy therefore does not prevent a bank from meeting its own liquidity needs with F-loans when it loses reserves. On the other hand, the use of F-loans beyond an individual need of this sort, for example, to relend NOK in the market, will increase the size of the bank's balance sheet and reduce its leverage ratio. This may limit the amount banks are willing to take out in the form of F-loans in order to relend, despite the fact that it may be highly profitable to do so.

#### **4.4.3. Internal guidelines**

In addition to regulatory constraints restricting banks' room for manoeuvre in situations where structural liquidity falls sharply, banks also have internal guidelines for balance sheet size and liquidity risk that may affect their leeway. These policies vary from bank to bank and may be altered over time. Several banks that are active in money markets and participate in Norges Bank's F-auctions report that such internal requirements can limit the amount they can borrow in F-loans. The guidelines can also set a limit for how much liquidity risk they can assume over various time horizons. This may restrict the amount they can plan to borrow in F-loans to fund lending in the money market.

Several of the largest banks with accounts with Norges Bank state that different internal guidelines limited their participation in Norges Bank's F-loan auctions in October 2022. Among other things, they note that they cannot take out large amounts of F-loans without internal approval, and that such clarifications may take up to several days. Some banks have quantified upper bounds for the amount they can borrow from Norges Bank in F-loans in consideration of balance sheet size and capital requirements. Some banks have self-imposed restrictions on taking on NOK liquidity risk, even though they are not subject to NOK LCR requirements. The fact that banks that normally use Norges Bank's F-loan facility faced such limitations and were not able to expand their room for manoeuvre at short notice probably contributed to the extreme price fluctuations in the FX swap market for NOK.

It was the magnitude of the fall in structural liquidity and the low bottom level that caused the above limits to contribute to the market turbulence in autumn 2022. In connection with previous petroleum tax due dates, where structural liquidity in the banking system has declined less, banks have had greater capacity for borrowing in F-loans in order to satisfy their own liquidity needs and to lend NOK in the money market.

## 5. Summary

NORGES BANK  
STAFF MEMO  
NO 15 | 2023

THE TURBULENCE IN THE  
NORWEGIAN MONEY MARKET  
IN AUTUMN 2022

The objective of Norges Bank's liquidity policy is to maintain the shortest money market rates close to the policy rate. In the days before and after the petroleum tax due date on 3 October 2022, the price of borrowing NOK at very short maturities in the FX swap market rose to extremely high levels. This was related to record-high payments to the government and the accompanying fall in structural liquidity.

Norges Bank's money market data indicate that it was the foreign banks without access to F-loans that had to meet their NOK needs in the money market at exceptionally high prices during the period. The abrupt increase in foreigners' borrowing of NOK from RPD reporting banks may be related to oil companies' NOK money market investments in the period prior to the petroleum tax due date.

Given the high NOK interest rates in the money market, one would expect banks with access to Norges Bank's market operations to make greater use of F-loans to relend to the market. During the period, however, bid volumes for Norges Bank's ordinary and extraordinary F-loans were low. Only a few banks with accounts with Norges Bank are large enough to trade substantial volumes in the money market, and these banks must participate in Norges Bank's market operations when structural liquidity falls sharply. Regulatory requirements and internal guidelines for banks with access to Norges Bank's F-loans limited their ability to borrow in F-loans and relend to foreign market participants. This was doubtlessly a significant reason for the market turbulence that arose around the petroleum tax due date.

# Appendix 1: Impact of petroleum tax due dates, F-loans and short FX swaps on the LCR

NORGES BANK  
STAFF MEMO  
NO 15 | 2023

THE TURBULENCE IN THE  
NORWEGIAN MONEY MARKET  
IN AUTUMN 2022

Financial institutions with LCR requirements in NOK must hold sufficient high-quality liquid assets (HQLA) to cover funding shortfalls for 30 days in a hypothetical stress situation. LCR is measured as HQLA as a share of net outflows over the next 30 days:

$$LCR = \frac{HQLA}{outflows - inflows}$$

In addition, there are requirements relating to the composition of the liquidity portfolio and how much inflows can be subtracted from outflows in the calculation. In addition, the liquid assets are subject to a haircut according to the expected fall in value in a stress situation, and different types of outflows and inflows count differently when calculating the denominator. In the present case, we overlook these factors. This lessens the negative effects on the LCR because the transaction volumes in the examples turn out to be more moderate than they are in reality. In any case, the mechanisms illustrated by the examples remain the same.

In the following, we envisage a large Norwegian bank which, in addition to NOK, has EUR and USD as important funding currencies. This bank has a 50 percent LCR in NOK, 100 percent in EUR and USD, and 100 percent in NOK, EUR and USD combined. Furthermore, we assume that towards the end of September 2022, the bank had a NOK liquidity buffer of about NOK 100 billion. Estimated outflows in NOK over the next 30 days are approximately NOK 200 billion, and inflows around NOK 50 billion. This results in an LCR in NOK of  $100 / (200 - 50) = 67$  percent. We assume that the oil companies have invested NOK 50 billion with the Bank in the period to the petroleum tax due date through FX swaps and time deposits. These mature at the same time as the petroleum tax falls due and count fully in outflows. Initially, the bank has 0 reserves and borrows NOK 50 billion in the form of F-loans to obtain a positive balance in Norges Bank after the tax due date.

Table 1 illustrates the effect of a loss of reserves, where the decline is offset by corresponding borrowing in the form of an F-loan. The effect on the LCR depends on which securities the bank uses as collateral for F-loans. When the FX swaps and time deposits mature, outflows in the denominator and reserves will fall equally. If the initial LCR is lower than



100 percent, this leads to a fall in the LCR. Furthermore, the LCR<sup>7</sup> will remain at a lower level than initially after borrowing in the form of an F-loan if the bank uses LCR securities as collateral for the F-loan. The reason for this is that encumbered securities are not included in the liquidity buffer in the LCR. F-loans against LCR securities in NOK as collateral only result in a shift from securities to reserves. If, on the other hand, the bank uses other forms of collateral, for example securities denominated in currencies other than NOK, the overall effect will be that the LCR in NOK rises. The liquidity buffer in NOK is then as large as previously, while net outflows have fallen by NOK 50 billion. The total LCR in NOK, EUR and USD will nevertheless fall if the pledged securities are included in the liquidity buffer in EUR or USD.

*Table 1: The effect on the LCR in NOK of a loss of reserves funded by F-loans.*

	Before payment	Tax payment	Pledged collateral			
			NOK LCR securities		Other	
<b>HQLA</b>	<b>100</b>	<b>50</b>	<b>50</b>		<b>100</b>	
Securities	100	100	50	(-50)	100	
Encumbered securities	0	0	50	(+50)	0	
Central bank reserves	0	-50	0	(+50)	0	(+50)
<b>Net outflows</b>	<b>150</b>	<b>100</b>	<b>100</b>		<b>100</b>	
Outflows	200	150	150		150	
Inflows	50	50	50		50	
<b>LCR</b>	<b>67 %</b>	<b>50 %</b>	<b>50 %</b>		<b>100 %</b>	

Table 2 shows the effect on the LCR of funding NOK lending in the form of T/N FX swaps with a one-week F-loan. This strategy will, under some assumptions, result in a lower LCR in the period when the bank rolls over its lending in T/N FX swaps. We assume that the bank has already used NOK 50 billion in LCR securities as collateral for F-loans to cover the loss of reserves after the petroleum tax due date. Furthermore, the bank wishes to fund NOK 10 billion in daily loans of NOK in T/N FX swaps with F-loans from Norges Bank. As previously shown, borrowing in the form of F-loans against LCR securities as collateral produces zero effect on the LCR. In the period when the bank rolls over its NOK loans at T/N, however, the LCR will fall if the counterparty does not hold an account with the bank, as the bank loses reserves. On the first day, the LCR in NOK will remain unchanged, since the only effect of lending in T/N is that inflows and outflows both rise by NOK 10 billion. The following day, however, outflows will drop by NOK 10 billion when the loan is settled. Inflows will remain unaffected, as the maturity takes

<sup>7</sup> Subtracting the same amount equally above and below the fractional line results in a lower value if the fraction is initially between 0 and 1, and a higher value if it is initially higher than 1.



place on the next business day. At the same time, reserves fall by NOK 10 billion. When the bank rolls over its NOK lending at T/N on the following day, both outflows and inflows will increase by NOK 10 billion. Overall, the liquidity buffer and net outflows fall by NOK 10 billion. If the LCR is initially lower than 100 percent, this strategy will lead to a lower LCR.

*Table 2: Effect of daily rollovers of NOK lending in T/N FX swaps on the LCR in NOK, financed by long-dated F-loans.*

	Start	F-loan	Lend NOK		Roll T/N	End
			T/N			
<b>HQLA</b>	<b>50</b>	<b>50</b>	<b>50</b>		<b>40</b>	<b>50</b>
Securities	50	40	(-10)	40	40	50
Encumbered securities	50	60	(+10)	60	60	50
Central bank reserves	0	10	(+10)	10	0	(-10) 0
<b>Net outflows</b>	<b>100</b>	<b>100</b>	<b>100</b>		<b>90</b>	<b>100</b>
Outflows	150	150	160	(+10)	160	(-10 + 10) 150
Inflows	50	50	60	(+10)	70	(+10) 50
<b>LCR</b>	<b>50 %</b>	<b>50 %</b>	<b>50 %</b>		<b>44 %</b>	<b>50 %</b>

It is difficult to know exactly the status of banks' LCR in the days before the petroleum tax due date, and other factors play a role as well. For example, the authorities that supervise Nordic banks domiciled outside Norway may apply LCR rules differently than the Norwegian supervisory authority (Finanstilsynet) does. The examples nevertheless indicate that petroleum tax due dates and NOK lending in T/N FX swaps result in lower a LCR if banks use securities included in the liquidity buffer in NOK as collateral for F-loans. The LCR requirement may therefore have constrained banks' ability to relend NOK during the market turbulence.