The Riksbank's review of Stibor

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Foreword

Benchmark rates are often determined on the basis of banks' assessments of interest rates. It is therefore important that they be surrounded by a clear and confidence-inspiring framework, and that it is possible to verify the benchmark rate from market pricing. The Riksbank has for a long time seen deficiencies in the framework surrounding the Swedish benchmark rate, Stibor, which may impact confidence in the benchmark rate.

Stibor forms the basis of many financial contracts that are of central importance to the ability of banks and non-financial companies to manage risk. It is thus an important component in the monetary policy transmission mechanism from the repo rate to the interest rates met by households and companies. At the same time, confidence in Stibor is important for the stability of the financial system. In light of this, the Riksbank has reviewed Stibor on several occasions for a long period of time.

In the autumn of 2011, staff at the Riksbank initiated a more comprehensive review of Stibor. As a part of this review, the Riksbank carried out interviews with people working on the determination of Stibor and examined the agreement regulating it. In addition, the Riksbank collected comprehensive statistics to empirically evaluate the framework surrounding Stibor. This report presents the results of this review.

The Riksbank will continue to take a more active role in the ongoing supervision and analysis of the pricing of Stibor. Among other steps, the Riksbank intends to produce a new assessment of Stibor in 2014 in order to follow up the reform work and the functioning of the framework surrounding Stibor. This activity is in line with the Riksbank's targets for financial stability and monetary policy. The Riksbank's analysis will be made available to the public so that it can contribute to the transparency surrounding Stibor.

The working group consisted of Johannes Forss Sandahl and Per Åsberg Sommar.[1] The working group has operated under the leadership of a steering committee consisting of representatives of the Financial Stability Department, the Monetary Policy Department and the Asset Management Department. Representatives of Finansinspektionen (the Swedish Financial Supervisory Authority) have also been included in the steering committee. Mattias Persson was chairman of the steering committee. Annika Svensson was editor.

Mattias Persson
Head of the Financial Stability Department

1 The working group would particularly like to thank Calum McDonald, Clara Fernström, Eric Frieberg, Mia Holmfeldt, Anna Jegnell, Martin W Johansson, Björn Jönsson, David Kjellberg, Erik Lenntorp, Caroline Leung, Jenny Mannent, Jonas Niemeyer, Elizabeth Nilsson, Kjell Nordin, Megan Owens, Marcus Pettersson, Göran Robertsson, Anders Rydén, Olof Sandstedt, Vanessa Sternbeck-Fryxell, Amelie Stierna, Staffan Viotti och Johanna Fager Wettergren.

1 Summary and introduction

The Stockholm Interbank Offered Rate (Stibor) is the generic term for a number of benchmark rates in Swedish kronor. These benchmark rates are used in different ways in the pricing of financial contracts in Swedish kronor corresponding to almost 50,000 billion Swedish krona. Stibor is therefore of great significance for Swedish interest rates, the allocation of capital in society and for the functioning of the financial markets. In conjunction with the outbreak of the international financial crisis in 2008, it became clear that there were problems with the benchmark rates, and these are currently being reviewed around the world. The Riksbank has examined Stibor on several occasions. This report presents the main findings of the latest review. In the results of the empirical evaluation in this review the Riksbank sees no signs of any manipulation of Stibor. However, the report shows that there are a number of deficiencies in the framework surrounding Stibor. These are related to the lack of an agent with overall responsibility for Stibor and the lack of a clear structure for governance and control. In addition, transparency concerning the pricing of Stibor is deficient and there are difficulties in verifying how Stibor is determined, above all for longer maturities. There is therefore scope for the adoption of reforms in these areas to strengthen confidence in Stibor. Against this background, the Riksbank has issued a recommendation concerning Stibor in the Financial Stability Report 2012:2.

The Swedish benchmark rate is defined as the interest rates that the banks in, what is known as, the Stibor panel on average specify what interest rate they can offer each other for unsecured loans in Swedish krona. Stibor is determined on a daily basis for eight different maturities. At present, five banks are included in the Stibor panel.

Stibor was established in 1986 and was initially mainly of importance for a small number of derivative contracts. As Swedish households and firms have to an increasing extent chosen loans with variable interest rates, Stibor has gained in significance. Stibor has been around for a long time and has largely fulfilled its purpose as a benchmark for pricing financial contracts. However, in connection with the financial crisis in 2008, it became clear that there were problems with benchmark rates around the world. The Riksbank has examined Stibor on several occasions and over a long period of time.

In the autumn of 2011, the Riksbank initiated a comprehensive review of Stibor. As part of this review, the Riksbank carried out interviews with individuals working on the determination of Stibor and examined the agreement regulating Stibor. In

addition, the Riksbank requested transaction data from the banks determining Stibor for the period 2007-2011. This data included unsecured interbank loans. The Riksbank also collected data on these banks' individual submissions from the start until the close of the submission process in which Stibor is determined for each banking day in the period 1997-2012.

Using this material as a starting point, this report describes the framework surrounding Stibor from a historical and international perspective. Based on the comprehensive data material, an empirical evaluation is also made. The aim is to identify possible shortcomings in the framework and to assess the conditions for verifying Stibor against market pricing.

The existence of plausible alternatives to Stibor as a benchmark rate cannot be ruled out. For example, it is possible that different types of benchmark rates could serve different purposes within the scope of the present use of Stibor. However, the starting point for this report is the market's choice of a benchmark rate, which is presently Stibor. Consequently, this report does not deal with any alternative benchmark rates. Apart from benchmark rates, there are also several types of benchmark prices, for example for commodities and currencies. This review does not examine these either.

THE IMPORTANCE OF BENCHMARK RATES

Benchmark rates can be seen as reference points for the pricing of financial contracts. They have existed for a long time and have generally succeeded in this purpose. Benchmark rates are most frequently determined on the basis of the banks' assessments of interest rates, rather than on the basis of actual market transactions. Consequently, the setting of interest rates needs to be organised in a manner inspiring confidence that the factors relevant for the pricing will be expressed in the determination of the benchmark rate, which is to say as if a real transaction was being conducted. A clear and confidence-inspiring framework and favourable conditions for verifying the benchmark rate on the basis of market pricing are central components in this.

Stibor's influence on the pricing of financial contracts makes it important to the Swedish economy and thus to the Riksbank. This applies to both monetary policy and financial stability. As Stibor is used in the pricing of many financial contracts, it is an important component in the monetary policy transmission mechanism from the repo rate to the interest rates met by households and companies. All other factors being equal, a change in the repo rate should affect Stibor to an equivalent degree and thus also the pricing of the financial contracts connected to Stibor. If this does not function for some reason, for example due to a lack of confidence, the conditions for monetary policy can be affected. Stibor is also important for the functioning of the financial markets, not least in the pricing of instruments

such as interest rate and foreign exchange derivatives, which are important to the risk management of banks and companies. Confidence in Stibor is thereby important for the financial stability in Sweden. Stibor also serves as a benchmark for the banks' cost for unsecured loans on the interbank market and thereby for the credit risk in the banking sector. Consequently, Stibor is also important for the assessment of the stability of the financial system.

THE NEED FOR REFORMS OF STIBOR

The analysis in the report confirms a number of deficiencies in the framework surrounding Stibor. Briefly, these deficiencies consist of:

- *Lack of responsibility.* The banks in the Stibor panel are jointly responsible for the agreement that regulates how the benchmark rate is determined. This means that no individual agent is responsible for the agreement and can be held accountable.
- *Lack of governance and control.* There is no clear structure to ensure confidence in Stibor. Among other shortcomings, there lacks an organisation to monitor whether the banks are complying with the Stibor agreement and to deal with questions or complaints regarding Stibor from external parties.
- *Lack of transparency in the process for determining Stibor.* The Stibor agreement is not public. Information on what Stibor is and how the benchmark rate is determined is not accessible either. This makes it difficult for external parties to assess and understand the benchmark rate.
- *Difficult to verify Stibor.* There is a lack of information on market pricing needed to verify Stibor. This is because Swedish banks to a great extent use foreign currency for their short-term funding and that there is no liquid Swedish market able to form a basis for the pricing of Stibor. The banks use unsecured interbank loans in Swedish kronor to a small extent.
- *Inadequate incentives in the submission process when Stibor is determined.* At present, the banks are not obliged to borrow or lend at their Stibor submissions. Consequently, the banks that determine Stibor do not have a strong enough incentive to give the correct Stibor rates, in the sense that they give the interest rates that they can actually offer for loans in accordance with the definition of Stibor. In addition, Sweden is a relatively small market with few banks on the Stibor panel, which entails a risk for collaboration between the banks when Stibor is being determined.

These shortcomings could undermine confidence in the benchmark rate and lead to inefficient pricing of risk in the financial system and distorted distribution

of capital in the economy. Reforms to strengthen confidence in Stibor should therefore be adopted. The report includes proposals for a number of reforms of Stibor that have also been included as a recommendation in the Riksbank's *Financial Stability Report 2012:2*:

- There should be an individual agent with a clear responsibility for Stibor and who can be held accountable for the functioning of Stibor. The present lack of any individual agent with this responsibility is impeding the work of carrying out necessary reforms. The organisation positioned to initiate this work is the Swedish Bankers' Association, as all banks in the Stibor panel are represented in this organisation at the managing director level. In addition, the Swedish Bankers' Association has a broad range of members who would thereby be given the opportunity of influencing the design of the framework for Stibor. However, it is not self-evident which agent would have the overall responsibility for Stibor in the long term.
- A clear framework for governance and control require there to be a unified framework with agreements and rules for Stibor that the banks in the Stibor panel can follow. It is also important to establish a clear structure to follow up compliance with this framework and to deal with questions and possible complaints about Stibor. To reduce the incentive for irregularities when Stibor is determined, the banks should also prepare a code of conduct for their internal organisations and work with Stibor.
- To create a transparent framework around Stibor, all agreements and regulations concerning Stibor should be public and easily accessible. Under the framework of its supervision of Stibor, the Riksbank and the Swedish Financial Supervisory Authority, Finansinspektionen, should be given full insight into all discussions and all matters concerning Stibor.
- To create appropriate incentives and to make it possible to verify the pricing of Stibor, the banks in the Stibor panel should be obliged to borrow and lend at their offers on request. This forms part of creating an incentive for the banks to ensure that their Stibor submissions are correct. To be better able to verify Stibor on the basis of market pricing, it would be best if the banks continuously issued and quoted rates for bank certificates in Swedish kronor for the relevant maturities. However, a minimum requirement is that the banks quote bid rates for their own bank certificates in Swedish krona.
- In addition, the number of maturities for which Stibor is determined should be reduced to cover the most frequently-used maturities. The size of the trading units should also be designed to create incentives for the banks to borrow and lend at each other's submissions. Smaller trading units should also increase the possibilities for more banks to participate in the submission process, which could strengthen confidence in Stibor.

The banks in the Stibor panel are well aware of these problems and are actively working to review the framework for Stibor. The Riksbank is an observer in this work. The deficiencies the banks intend to rectify are in line with those the Riksbank has identified and now it remains for the banks to take the decisions needed to address the problems. This is also a condition for strengthening the confidence in Stibor. All the indications are that the necessary decisions will be taken before the end of 2012 and that these will be implemented in the first quarter of 2013.

INTERNATIONAL REVIEW OF BENCHMARK RATES

A comprehensive review of benchmark rates is also taking place internationally due to the discovery of a number of deficiencies, above all since the outbreak of the financial crisis in 2008. Since 2009, supervisory authorities in the United Kingdom, United States, Canada, EU, Japan and elsewhere have reviewed the benchmark rates Libor (London Interbank Offered Rate), Euribor (European Interbank Offered Rate) and Tibor (Tokyo Interbank Offered Rate). In conjunction with it becoming known that the British major bank Barclays had manipulated Libor, Martin Wheatley, the designated Managing Director of the Financial Conduct Authority, was assigned to review Libor, which has resulted in a number of proposed measures (see the box Benchmark rates are examined internationally).

Many international organisations in which the Riksbank also participates have also initiated work on reviewing internationally important benchmark rates and indices. This work is focused on working out guidelines and principles for how these are to be determined, reviewed and supervised. It also aims to coordinate work in this area conducted in different countries.

The Riksbank is monitoring international developments and there may in the future be necessary to adjust the framework for the Swedish benchmark rate Stibor to the changes taking place. At the same time, it is important to take into account the differences existing between different benchmark rates, for example how different benchmark rates are defined, who has responsibility for the benchmark rate, and differences in the processes of determining them. These differences mean that reforms suitable for other countries may not be most appropriate for the Swedish system.

The Riksbank will monitor and analyse the pricing and framework of Stibor more continuously in the future. Among other steps, the Riksbank intends to produce a new assessment of Stibor in 2014 in order to follow up the reform work and the functioning of the framework surrounding Stibor. The supervision of Stibor will also be changed. For example, the European Commission has proposed the introduction of a requirement for the supervision of benchmark rates to restrain conflicts of interest and promote internal organisation, which would mean that

Finansinspektionen would be given explicit responsibility for the supervision of Stibor.

Alongside the European Commission's work, there may also be reason to consider whether benchmark rates of a certain scope should be subjected to regulation under commercial law. Such regulation need not necessarily cover the methods for determining the benchmark rate. Rather, this would be a matter of setting up certain minimum requirements for responsibility, transparency and supervision by public authorities.

2 How benchmark rates work

When two parties enter into a financial contract, the price is central. It is also natural for the negotiation between the parties about the price, or the interest rate, to be time-intensive and costly. For this reason there are obvious gains from standardising the pricing process by developing a common benchmark, particularly within the financial sector where a large number of contracts are entered into on a daily basis. This is the fundamental purpose of benchmark rates. In principle, it can be said that a benchmark rate functions as a base from which the parties agree on a mark-up that captures the specific conditions of a given contract. By using a benchmark rate, the parties do not need to negotiate the base, but rather only the mark-up. This can decrease the costs related to the negotiation of financial contracts and, since it becomes easier to enter into a contract, improve liquidity on the market.

In order for market participants to use a benchmark rate, this rate must be able to truly function as a basis for the setting of interest rates in financial contracts, reflect the factors that are relevant. The process for setting the benchmark rate must also be governed by a framework which inspires confidence that these factors are also correctly reflected in how the benchmark rate is set.

With regard to financial contracts, the market participants have reached a point where they prefer to use interbank rates as benchmark rates (see the next section). Interbank rates are the interest rates that banks require from one another for unsecured short-term loans. Therefore, interbank rates are considered to reflect the banks' cost of borrowing money (see the box Funding of Swedish Banks). The size of this cost is dependent, for example, on the market liquidity and how creditworthy the banks are judged to be. The interbank rate therefore reflects the banks' liquidity risk and credit and counterparty risks, among other risks. Regardless of whether or not the banks use secured funding instruments in their liquidity management, their creditworthiness will affect their cost of borrowing money. Therefore, the market has made the assessment that benchmark rates based on interbank rates are an appropriate basis for financial contracts between banks. Even if non-financial companies or households are the ultimate borrowers or investors, financial transactions are often intermediated by banks in the financial system, thus providing justification even in these cases to use benchmark rates that reflect the banks' average liquidity risk and credit and counterparty risks.[2]

2 See the Riksbank's report, Financial Stability 2012:1.

However, since a benchmark rate is primarily determined by banks' assessments of interest rates and not by actual transactions on the market, the pricing needs to be organised in such a manner as to inspire confidence, i.e. "as if" a real transaction is taking place. Central components in this type of framework are how the benchmark rate is defined, who determines the interest rate and how it is set, which governance and control functions exist, and, in particular, how responsibility can be accounted for. The framework also needs to be transparent in order to create confidence in the benchmark rate.

This chapter discusses the purpose of benchmark rates in more detail and looks at them from a historical perspective. The Swedish benchmark rate, Stibor, is then described and also placed in an international context.

2.1 Benchmark rates from a historical perspective

There has been a need for benchmark rates for financial contracts for a long time. Up until the 1970s the rates on treasury bills were used as benchmark rates for financial contracts. Interest rates on government securities, however, proved to be less appropriate as benchmark rates since the pricing is influenced in part by factors other than those that influence the pricing of many other financial contracts. For example, the interest rates of treasury bills are influenced by changes in government funding needs. During times of great uncertainty, the interest rates of government securities are also affected by a "flight to quality", i.e. when investors prefer liquid debt securities with low credit risk. As a result of the development on money markets throughout the world during the 1970s followed by the growth of the derivatives markets, there was a growing need to have benchmark rates that were more relevant for setting the price of the majority of financial contracts. More specifically, benchmark rates were needed that to a greater extent reflected the cost for banks and companies in the private sector to borrow money. These interest rates were more appropriate than the rates for treasury bills when managing the risk in banks' and companies' funding costs. Given this background, the market began instead to allow the benchmark rates to reflect the interest rates for loans between banks.

At first, the interest rates for a given currency that highly respected banks on the international market, primarily American or British, stated that they were willing to use in trading with other banks were used as a kind of benchmark. Eventually, however, a more formal framework for benchmark rates was established. The first benchmark rate was the British London Interbank Offered Rate (Libor), which began to be calculated and published at the end of the 1970s. It was calculated and published in an informal manner and was based on the deposit and lending interest rates that banks with high credit quality stated in US

dollars.[3] Back then, there was also frequent trading due to the banks' extensive use of interbank loans in their funding. The benchmark rate therefore functioned as a type of barometer for where the market rates were at a given point in time. In 1985, the British Bankers' Association (BBA) began to calculate and publish the benchmark rate. The transfer to the BBA, however, was mainly a formal act since Libor continued to be determined and used in the same manner.[4]

The foundation for the Swedish money market, i.e. the market for short-term debt instruments, was established first in 1984, for example through the introduction of a framework for market makers that warrant the liquidity in the market. As new financial instruments, such as various interest rate derivatives, were developed and began to be used more frequently, a need emerged for a common, appropriate benchmark rate. The dominant banks on the Swedish money market established Stibor in 1986.

The financial system has undergone major structural changes since these benchmark rates were established. One of these changes is that banks are to a lesser degree turning to the interbank market for their short-term funding but rather are opting to issue certificates. For Swedish banks, another change is also that the share of funding in foreign currency has increased significantly over time (see the box Funding of Swedish Banks).

3 Banks that in some cases fall under the classification "prime banks" or first-class banks.

4 See McCauly (2001), Gadanecz (2004) and Gyntelberg and Wooldridge (2008) for discussions regarding how the need for benchmark rates grew over time.

Funding of Swedish banks

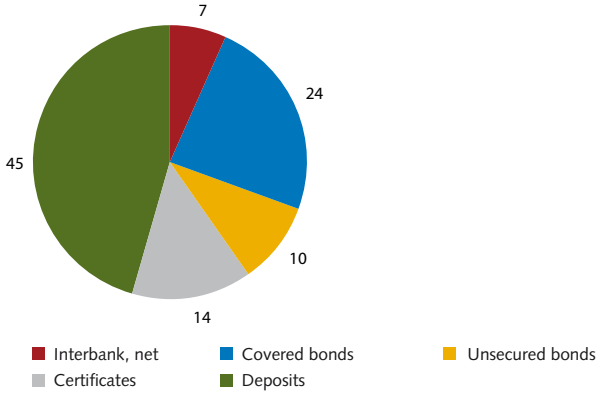
Stibor serves as a benchmark for the banks' cost of borrowing money. The composition of the banks' short-term funding is therefore important for the analysis of how Stibor is determined. This box describes how the Swedish banks fund their operations.

Since the 1970s, Swedish banks have switched from a funding model based primarily on deposits from the non-bank public to a model based on market funding, to a large extent in foreign currency. There are several potential reasons why this switch occurred. The deregulation of the financial sector in the 1980s gave banks greater possibilities for deciding their own operational focus and funding model. Households were also given greater possibilities for using different types of financial saving, which meant that household savings to less of a degree have gone directly to the banks as deposits. Even changes to the pension system where households were encouraged to save more in securities can have had an impact.

Today, around half of the funding of Swedish banks comes from market funding and half from deposits (see Chart A1). Banks therefore fund a large portion of their lending with market funding, which consists primarily of issued securities. The long-term portion of this market funding consists of bonds, mostly covered bonds, while the short-term portion consists mainly of bank certificates. Borrowing on the interbank market is certainly part of the short-term market funding, but it can primarily be viewed as a means of balancing liquidity. The majority of the banks' market funding takes place in foreign currency (see Chart A2). This applies in particular to the short-term portion, of which around 90 per cent is in foreign currency (see Chart A3). Only around 1.5 per cent of the banks' total funding comes from certificates in Swedish krona. The largest portion of the foreign funding is used to fund assets in the corresponding currency, but approximately one fourth of the total foreign funding is used to fund lending in Swedish krona. To avoid undesired effects from currency fluctuations, the banks exchange this type of funding for Swedish krona using foreign exchange swaps.

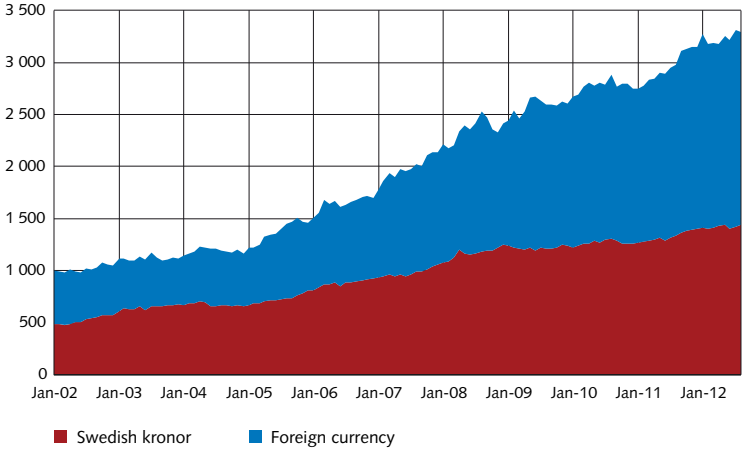
In summary, this means that interbank loans and certificate funding in Swedish krona only constitute a small portion of the banks' total funding, and that foreign exchange swaps are of importance in the banks' funding costs.

Chart B1. Funding of the major Swedish banks, September 2012
Per cent



Note. Refers to the major Swedish banking groups.
Sources: The banks' financial statements and the Riksbank

Chart B2. Market funding in Swedish krona and foreign currency
SEK billion



Note. Refers to Swedish monetary financial institutions (MFI) and therefore excludes foreign subsidiaries.
Sources: SCB and the Riksbank

2.2 Stibor, the Swedish benchmark rate

Stockholm Interbank Offered Rate (Stibor) is a generic term for a number of benchmark rates in Swedish krona that in different ways are used for the pricing of many different financial contracts. For example, they form the basis for the pricing of interest rate derivatives, which has an outstanding volume of 38,000 billion Swedish krona. They are also often compared to the pricing of foreign exchange derivatives at an outstanding volume of more than 6,000 billion Swedish krona. In addition, they are often used as a benchmark when setting the prices of financial institutions' loans with variable interest rates to Swedish companies and households, which totals around 3,000 billion Swedish krona. Finally, Stibor serves as a basis for the pricing of bonds with variable rates at an outstanding volume of around 500 billion Swedish krona. In total, Stibor is used as benchmark rates for loans and financial contracts at an outstanding volume of more than 47,000 billion Swedish krona.[5]

Table 1 contains nominal amounts reported by the Stibor banks. These amounts refer to contracts that are directly linked to Stibor. The table shows that the largest volume of the financial contracts is directly linked to the benchmark rate for the three-month maturity, while relatively small volumes are linked to the maturities for 2, 9 and 12 months. The table also shows that there is more or less a balance between assets and liabilities in the banks' aggregate position. This indicates that there is no obvious reason for the banks to set Stibor too high or too low, which could have been the case if their assets had been larger than their liabilities or vice versa.

5 This amount is based on nominal amounts for financial contracts, not market values. It is also a gross amount, which means that the nominal amounts for liabilities and assets have been totalled. The amount includes mortgages and corporate loans at variable rates as well as variable rate bonds and interest rate swaps, interest rate forwards and foreign exchange swaps. Sources: Dealogic, Finansmarknadsstatistik, December 2011; SCB and Detailed tables on semi-annual OTC derivatives statistics at end-December 2011; Bank for International Settlements (BIS).

Table 1. Contracts dependent on Stibor at different maturities
Nominal amounts, SEK billion

	ASSETS	LIABILITIES
T/N	570	598
1 week	13	39
1 month	141	133
2 months	18	8
3 months	21 362	21 180
6 months	31	39
9 months	1	1
12 months	13	29
Total	22 149	22 027

Note. The numbers in the table are based on reported data from Danske Bank, Handelsbanken, Nordea, SEB and Swedbank, and is therefore not equivalent to the total outstanding volume of financial contracts linked to Stibor.
Source: The Riksbank

Stibor is regulated via an agreement that is not public. With the aim of reviewing and analysing Stibor, the Riksbank has examined the Stibor agreement and conducted interviews with bank employees that make the banks' Stibor submissions. The description below is a result of this analysis.

WHO DETERMINE STIBOR?

The banks that determine Stibor are part of the "Stibor panel", which consists of Danske bank, Handelsbanken, Nordea, SEB and Swedbank (the Stibor banks[6]). The Royal Bank of Scotland (RBS) used to be a member of the Stibor panel, but it chose to withdraw in April 2012.[7] The Stibor panel itself has formulated the most recent version of the agreement from 2006 that serves as a basis for the banks' undertaking to set Stibor. Since the agreement is not public and there is generally no information publically available about the framework for Stibor, the Stibor banks have better access to information than other users of financial contracts linked to Stibor.

The agreement does not establish which rules each Stibor bank should follow in its work to determine Stibor and how this work should be organised. Based on the Riksbank's interviews with the Stibor banks, however, it becomes apparent that the responsibility for making each individual bank's daily Stibor submissions lies primarily with the banks' treasury departments, which are responsible for the banks' funding. One important reason for this allocation of responsibility is that the Stibor submissions should reflect a bank's costs of borrowing money. Another is that the banks' treasury departments are often separate from the other operations in the bank, such as, for example, trading on behalf of customers and

6 These banks are referred to later in this report as "the Stibor banks".
7 RBS assumed a position on the Stibor panel in conjunction with its acquisition of ABN Amro in 2007, which at that time was a member of the Stibor panel.

to some extent the bank's own financial assets. By separating these functions, there is less incentive for individual traders' or the bank's own net trading positions to influence which submissions the bank makes when setting Stibor. The task of determining and making the bank's Stibor submission in some cases is handled by a single person and in other cases rotated among members of the group that is responsible for the bank's short-term funding.

HOW IS STIBOR DEFINED?

There currently is no clear definition of Stibor, although the agreement and the interviews conducted by the Riksbank indicate that Stibor should fulfil a number of criteria.

- First, Stibor should refer to unsecured loans in Swedish krona with different maturities. Stibor is currently set using maturities for tomorrow-next (T/N), 1 week and 1, 2, 3, 6, 9 and 12 months.
- Second, Stibor should correspond to offered rates. This means that the interest rates should not refer to rates for actual raised loans.
- Third, Stibor should be set by the banks in a panel (the Stibor panel) and refer to loans between these banks. Each bank in the Stibor panel should state what interest rate it can offer to the other banks in the panel. Stibor should then be calculated as an average of these rates.

One interpretation of this is that Stibor is defined as the interest rate a bank in the Stibor panel can offer to other banks in the panel for unsecured loans in Swedish krona with different maturities.

HOW IS STIBOR DETERMINED?

The agreement states that Stibor should be determined every business day via the process described in Table 2.

Table 2. Process for setting Stibor

TIME	EVENT
10:45-10:55 a.m.	The banks in the Stibor panel submit their interest rates, or Stibor submissions. After the first bank to submit has made its submissions on all maturities, the other banks can make their submissions. The banks can adjust their submissions throughout the entire submission process. The banks can see each other's submissions in the Thomson Reuters information system. Other parties that have Thomson Reuters can also see this information.
10:55-11:00 a.m.	According to the original agreement, the banks have the option of borrowing or making deposits at each other's submissions during the submission process. Loans are issued at the stated submissions, while deposits are made at the stated submission minus 0.12 percentage points. The banks should be prepared to lend or receive unsecured amounts of up to 500 million Swedish krona for all maturities up to 6 months and 100 million Swedish krona for the maturities 9 and 12-months. If any of the banks requests to lend or make a deposit at another bank's stated submission, the other bank can either adjust its submission or complete the transaction. This is a result of the possibility for the banks to adjust their submissions at any time during the entire submission process.
11:00-11:05 a.m.	The submissions are reported to Nasdaq OMX, which calculates the Stibor interest rate for each maturity. The interest rates are calculated as the arithmetic mean of the submissions. If the highest or lowest submission deviates by more than 25 basis points from the second highest or second lowest submission, respectively, it is excluded before the average is calculated. The interest rates are then published in Thomson Reuters no later than 11:05 a.m.[8]

THE SUBMISSION PROCESS FOR STIBOR WAS MODIFIED IN CONJUNCTION WITH THE CRISIS IN 2008

As a result of the filing for bankruptcy protection by the American investment bank Lehman Brothers in September 2008, the global financial system suffered a confidence crisis. Uncertainty increased and made it difficult for financial market participants to assess and value risks. This also had an effect on the Swedish banks, which use foreign currency for their funding, in that they had difficulty raising funding on the international securities markets. The increased uncertainty on the interbank market meant that it became difficult for the banks to assess and value liquidity risk and credit and counterparty risks. The crisis also resulted in the risk premiums for the different banks varying more than they had before. The banks, therefore, became less willing to borrow from or make unsecured deposits with one another (see Chart 1).

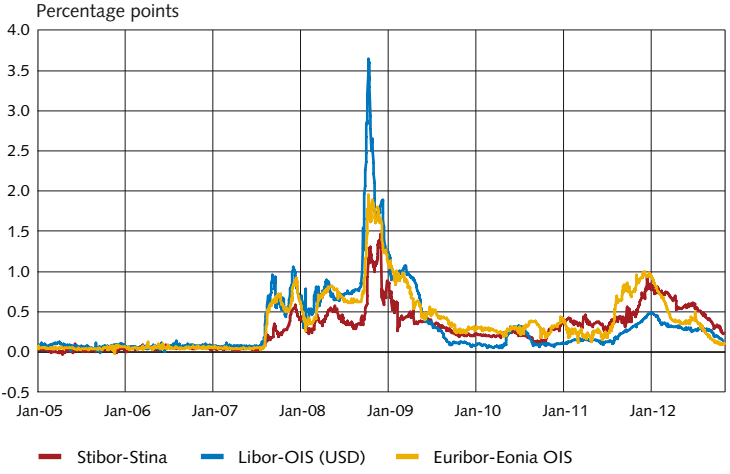
On 29 September 2008 the banks on the Stibor panel agreed as of that day to abandon the stipulation that they, upon request, were obligated to either adjust their submissions or undertake to borrow or make deposits at them. The reasons for this were the increasing liquidity risk on the global market and that the banks subsequently no longer wanted to burden their balance sheets with potential loans or deposits at their Stibor submissions.

Since the financial crisis, the banks can still see each other's submissions, but they are not obligated to borrow or make deposits at these rates. The banks can also still adjust their submissions up to 11:00 a.m., at which time the submission process is closed. This change has introduced a weaker incentive structure in the

8 The method of calculation and the time of publication is stated on the Nasdaq OMX website.

submission process, even if the banks previously could, in practice, change their submission instead of lending or receiving funds at the rate they submit.

Chart 1. Risk premiums on the inter-bank market
Percentage points



Note. Calculated as the difference between the three-month benchmark rate and the overnight indexed swap (OIS) rate. Unlike the OIS rates in US dollar and euro, Swedish STINA does not reflect the expectations for the future O/N rate but rather the expectations for the future T/N.
Source: Reuters EcoWin

2.3 Stibor from an international perspective

Benchmark rates differ between countries. In this section, Stibor is compared to London Interbank Offered Rate (Libor), European Interbank Offered Rate (Euribor), Copenhagen Interbank Offered Rate (Cibor) and Norwegian Interbank Offered Rate (Nibor). Differences in how benchmark rates are determined mean that possible deficiencies might differ as well, which plays a role in how they should be resolved. There is no guarantee that there is a solution that is suitable for all benchmark rates.

DIFFERENCES IN THE DEFINITION OF BENCHMARK RATES

There are differences in what the benchmark rates in different currencies should reflect. Table 3 shows that when Stibor is set a bank should base its submission on what it believes it can offer as a rate to the other Stibor banks. When Libor is set, the bank should instead base its submission on what rate it believes it could be offered from the other banks. The difference is that a bank should assess its own offered lending rate when setting Stibor, but it should assess the lending rates that other banks have offered the bank itself when setting Libor. There can be grounds for individual banks in the Libor panel to not show the borrowing rates they are actually seeing in their funding since a high borrowing rate could indicate that the

bank has financial problems. This could mean that the banks are facing incentives to state rates that are too low when they are setting Libor.

When Euribor and Cibor are set, the bank should assume that the counterparty is a financially strong bank with high creditworthiness (i.e. a "prime bank"). In the case of Euribor, the bank should not include itself but rather make an assessment of the borrowing rates between two typical banks of this kind. The benchmark rate is therefore purely hypothetical since no bank needs to justify its submission through trade. Libor was determined in a similar way until 1998. When Nibor is set the bank should assume that the counterparty is a bank that is active on the money and currency markets for Norwegian krona, which to some extent is similar to how Euribor and Cibor are set.[9]

DIFFERENCES IN THE SUBMISSION PROCESS

When setting the benchmark rate, a submission process is started between the banks where all of them make a submission in accordance with the definitions outlined above. The submission process for Libor, Euribor and Cibor are closed, which means that the banks in the panel cannot see each other's submissions during the submission process. On the contrary, the submission process for Stibor is open, which means that the banks on the panel, and others, can see the submissions. To be able to see the submissions, however, requires access to certain information systems, which is associated with a cost in the form of a fee. In practice, primarily only the banks themselves and other participants on the money market have access to the information about the submissions.

The differences in public disclosure are related to the incentives for the panel banks to make correct submissions. The idea behind an open process with public submissions is that the banks should have the option of making transactions at each other's submissions and through competition reach a final interest rate that is at a competitive level. As previously mentioned, the Stibor banks could close transactions at each other's submissions before the financial crisis. At the same time they could see each other's submissions from the start and had the option of changing their submissions instead of making loans or accepting deposits upon request. This means there was a risk that the banks' submissions would be similar.

The idea behind a closed process with concealed submissions is to reduce opportunities to collaborate since the banks cannot see each other's submissions. However, since the banks are not obligated to stand behind their submissions, there are also weaknesses in this type of process. Since each bank's submission is published after the final benchmark rate has been calculated, there is incentive for the banks to make submissions that are too low in order to not show any financial

9 Bernhardsen et al (2012) analyses the risk premiums in the Norwegian benchmark rate, Nibor.

weakness. This type of manipulation was one of the reasons the British bank Barclays was fined in June 2012.[10] The closed submission process also does not eliminate the possibility that the banks or individual traders face incentives to make too high or too low submissions based on which would give them the highest remuneration. For example, a bank could have a large volume of lending linked to the benchmark rate, but only a limited volume of funding linked to it. This would make it beneficial for the bank to make submissions that are too high when setting the benchmark rate in order to get as good of a return on its assets as possible.[11]

DIFFERENCES IN THE NUMBER OF MATURITIES

There are also differences in the number of maturities for which the benchmark rates are set. Stibor is set for T/N and upwards. This is different from Euribor, Cibor and Nibor, which are set for maturities of 1 week and upward.[12] On the markets for these benchmark rates, it is the central bank instead that has the responsibility for calculating the interest rates for the shortest maturities, O/N and/or T/N, based on the traded rates for unsecured interbank loans. These rates are calculated based on interest rates on actual funding transactions as opposed to benchmark rates such as Libor and Stibor which are based on banks' assessments. On the Swedish krona market there are no transaction-based interest rates for the shortest maturities. Instead, Stibor T/N is the only short-term rate that is published, while the interest rate for the O/N maturity is not set at all.

DIFFERENCES IN THE NUMBER OF BANKS ON THE PANEL

The number of banks included in the submission process also differs for each benchmark rate. This is due to the differences between the financial markets and the number of active banks, as well as to the requirements for the banks that are on each panel. Euribor has a wide catchment area with a large market and therefore a large number of active banks that participate in the process of setting the benchmark rate. The Euribor panel also includes several smaller banks. This makes it different from the panels for the other benchmark rates, including Stibor, which exclusively include the largest banks that participate in liquidity management in each currency.

10 See the press release dated 27 June 2012 from FSA "Barclays fined £59.5 million for significant failings in relation to Libor and Euribor". Link to the press release: http://www.fsa.gov.uk/.

11 Abrantes-Metz and Evans (2012) highlight the importance of the banks being obligated to stand behind their submissions in order to provide them with the incentive to make correct submissions when setting the benchmark rate. Without such binding commitments, a closed process with concealed submissions is not sufficient for avoiding that the banks will make the same or similar submissions. To decrease the banks' opportunities for collaborating when setting the benchmark rates, it is instead suggested that individual banks' submissions be published with at least a one-month delay.

12 The Wheatley report proposes that Libor in the long run will not be set for the O/N maturity.

DIFFERENCES IN RESPONSIBILITY

Stibor is regulated by an agreement between the banks on the panel, which gives rise to collective responsibility and thus can be an ambiguous method of control. The responsibility for the other benchmark rates has to date been more clear since the bankers' association in each country or currency region has been responsible for the framework.[13,14]

DIFFERENCES IN HOW BENCHMARK RATES ARE CALCULATED

All of the benchmark rates are calculated as arithmetic means after the removal of some extreme values. The difference lies in which extreme values are removed, which in part can be said to depend on the size of each panel. In order not to undermine the statistical base of the calculation, it is not possible to remove a significant portion of the submissions in the calculation. The effect becomes particularly evident for Stibor since its panel only consists of five banks. Therefore, the highest and lowest submissions are removed only if they deviate by more than 25 basis points from the second highest and second lowest submissions, respectively. This procedure differs from the other benchmark rates, which have more banks on their panels. Cibor and Nibor are calculated after the highest and lowest submissions are always removed, which gives a statistical base of five and four submissions, respectively, when calculating the arithmetic means. Since the panels for Libor and Euribor are larger, it is possible to be stricter in the removal of extreme values. They remove 25 and 15 per cent, respectively, of deviant submissions before the means for these benchmark rates are calculated.

13 With regard to Libor, the Wheatley report recommends that responsibility for Libor should be transferred from the British Bankers' Association to a new, independent market participant selected via a tender procedure.

14 In Denmark, Danmarks Nationalbank was previously responsible for gathering data for and calculating and publishing Cibor, but as of April 2011 this responsibility was transferred to the Danish Bankers Association. Danmarks Nationalbank no longer wanted to be responsible for Cibor since the turnover volume on the market for unsecured loans was so small that it was not possible to evaluate the quality of the benchmark rate. Danmarks Nationalbank also could not rule out that the banks were in violation of competition legislature when setting Cibor, see Danmarks Nationalbank (2012). In their review of Cibor, the Ministry for Business and Growth stated that there were a number of deficiencies surrounding Cibor. In order to restore confidence in the benchmark rate system, it was proposed, among other things, that a new supplemental benchmark rate, called CITA, should be established based on the market prices for interest rate swaps and that public supervision of benchmark rates and stricter regulations in the area should be implemented, see Erhvervs- og vaekstministeriet, (2012).

Table 3. Comparison of different benchmark rates

	STIBOR	LIBOR	EURIBOR	CIBOR	NIBOR
Loan type	Unsecured interbank loan	Unsecured interbank loan	Unsecured interbank loan	Unsecured interbank loan	Unsecured interbank loan
Definition	The interest rate the bank can offer another bank on the panel for a loan.	The interest rate the bank believes it can be offered for a loan from another bank on the panel.	The interest rate the bank believes that "prime banks" in the euro zone would offer one another for loans.	The interest rate the bank can offer a "prime bank" for a loan.	The interest rate the bank offers to a leading bank that is active on the money and currency markets for Norwegian krona.
Submission process when the rate is set	Public submissions, previously possible for the banks to borrow and make deposits at each other's submissions (until 2008).	Concealed submissions that are disclosed when Libor is published.[15]	Concealed submissions that are disclosed when Euribor is published.	Concealed submissions that are disclosed when Cibor is published.	Public submissions based on the current spot price for USD/NOK, the panel banks' current forward prices for foreign exchange swaps in USD/NOK and Libor, which is also recalculated to a NOK rate[16]
Maturities	T/N, 1 week, and 1, 2, 3, 6, 9, 12 months	O/N, 1 week, 2 weeks, 1-12 months	1 week, 2 weeks, 3 weeks and 1-12 months	1 week, 2 weeks and 1-12 months	1 week, 2 weeks and 1, 2, 3, 4, 5, 6, 9, 12 months
Number of banks on the panel	5	16 (GBP), 18 (USD)	43	7	6
Responsibility	Banks on the Stibor panel	British Bankers Association	European Banking Federation (EBF)	Finansrådet[17]	Finance Norway[18]
Calculation	Nasdaq/OMX calculates the arithmetic mean. The highest or lowest submissions that deviate by more than 25 basis points from the second highest or second lowest submission are removed.[19]	Thomson Reuters calculates the arithmetic mean after the 25 per cent highest and lowest submissions have been removed.	European Banking Federation (EBF) calculates the arithmetic mean after the 15 per cent highest and lowest submissions have been removed.	Nasdaq/OMX calculates the arithmetic mean after the highest and lowest submissions have been removed.	Thomson Reuters calculates the arithmetic mean after the highest and lowest submissions have been removed.

15 The Wheatley review, however, proposes that the disclosure of individual submissions should be delayed to avoid incentives for banks to make submissions that are too low in an effort not to signal financial weakness, and to decrease the opportunities for the banks to collaborate to set the benchmark rate.

16 This calculation is made via the interest rate parity relationship that states that the ratio between a forward and spot price for two currencies should be equal to the ratio between the interest rates for borrowing and making deposits in both currencies.

17 The Danish equivalent to the bankers association.

18 The Norwegian equivalent to the bankers association.

19 Stibor was previously calculated as an arithmetic mean after the highest and lowest submission had been removed. When RBS withdrew from the Stibor panel in April 2012, the calculation method was changed to the current method.

3 Empirical evaluation

This chapter evaluates the framework for Stibor based on empirical data. The evaluation is based on two main sets of data (see Figure 1).

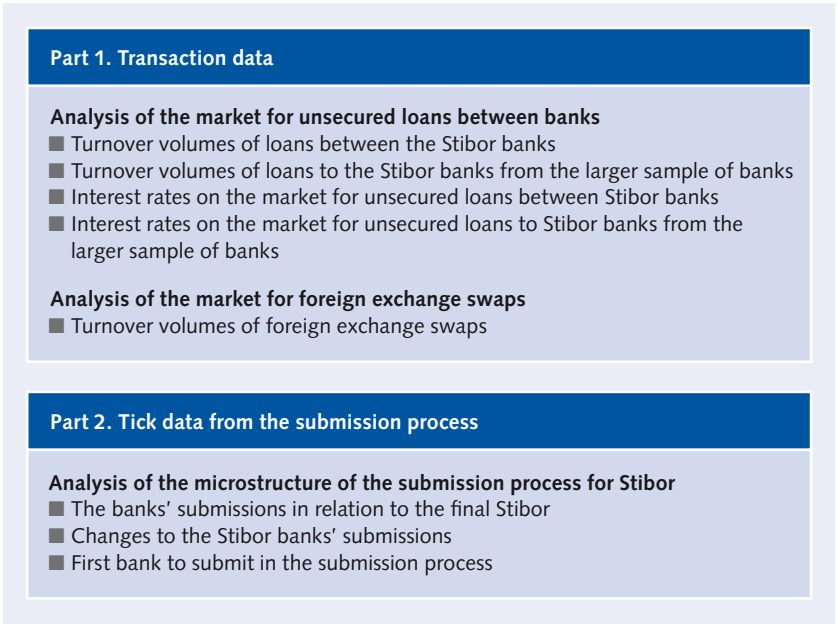
The first part is based on the transaction data that the Riksbank gathered from the Stibor banks. The purpose is primarily to analyse the conditions for setting and evaluating Stibor based on traded loan rates and evaluating how well the benchmark rate has reflected pricing on the market. The more transactions, the better are the conditions. For this analysis the data for turnover volume and rates on the market for unsecured loans between the banks was used.

Another purpose is to analyse the conditions for setting and evaluating Stibor based on the pricing of foreign exchange swaps. This is justified since the banks to a large extent use these financial contracts to transform funding in foreign currency to Swedish krona, which represents 90 per cent of the banks' short-term market funding.

The second part is based on per-second data of the banks' daily submissions during the 15 minutes between 10:45 a.m. and 11:00 a.m. when Stibor is set. This analysis aims to study the microstructure of the submission process to evaluate whether it is appropriately structured.

The chapter starts with a review of the data sets that form the basis for the analysis. The results from the analysis are then presented in accordance with the order illustrated in Figure 1.

Figure 1. Empirical analysis based on two data sets



The empirical analysis draws the following conclusions:

- In the results of the empirical evaluation there are no signs of any manipulation of Stibor. However, it is difficult to verify Stibor above all for longer maturities since the market for unsecured interbank loans is illiquid for the longer maturities for which Stibor is set. Hence, there are few possibilities for being able to set and evaluate Stibor using traded rates. In practice it is only possible to do this for the shortest maturities, O/N and T/N.
- There is frequent trading in foreign exchange swaps for all of the maturities for which Stibor is set and the conditions for being able to set and evaluate Stibor using the prices of these instruments are better than using interest rates on unsecured interbank loans. A comparison between Stibor and the rates in Swedish krona implied by the prices of foreign exchange swaps in euro and dollar also show that Stibor has been set at reasonable levels. However, there are problems related to verifying Stibor through foreign exchange swaps that are related to the fact that there is no common practice for storing information about what is used as the basis for the pricing of foreign exchange swaps.
- The analysis of the microstructure in the Stibor submission process shows that this process is not fit for its purpose. The open submission process

opens the door for strategic submissions and enables the Stibor banks to influence each other's submissions during the submission process. There is a risk that this will result in a behaviour where the Stibor banks in the end will all place the same submissions or submissions that are similar to one another instead of each individual Stibor bank making a submission that it believes to be correct.

3.1 Data and limitations

TRANSACTION DATA

The Riksbank requested statistics from the Stibor banks in December 2011. This data consists of all transactions with unsecured interbank loans, foreign exchange swaps, certificates and repurchase agreements with maturities of up to one year that the banks' treasury departments conducted during the period 2007-2011. This data forms the basis for the analysis of the turnover volumes and interest rates for unsecured interbank loans and for the evaluation of foreign exchange swaps as a basis for setting and evaluating Stibor.

The limitation of the data set to the treasury departments' transactions was made because these departments handle the banks' funding. The banks' costs for borrowing money serve as the basis for the interest rates the banks can offer on loans, which should be reflected in Stibor. In addition, it is the treasury departments that make the banks' Stibor submissions to Thomson Reuters on a daily basis. The treasury departments, however, conduct only a limited portion of the banks' transactions with foreign exchange swaps, certificates and repurchase agreements. The largest portion is conducted within the framework of the banks' operations that execute services on behalf of the banks' customers. It is important to keep this limitation in mind when analysing the turnover volumes of foreign exchange swaps since the data does not reflect the market as a whole.

The analysis of unsecured interbank loans is limited to the Stibor banks' borrowing from each other and from other banks. The banks' lending is excluded from the analysis. This means that the data always consists of traded rates that depend on the Stibor banks' creditworthiness. Furthermore, if the Stibor banks' lending would have also been included, the loans between the banks would have been counted twice. For a loan, one Stibor bank's lending rate constitutes the other Stibor bank's borrowing rate.

The analysis of the unsecured interbank loans is based primarily on loans between the banks on the Stibor panel. This is the most relevant analysis since it is the rates for loans between these banks that are referred to in the definition of Stibor. Then all of the banks' unsecured loans from other banks, i.e. not only from the Stibor banks, are included in the analysis. These banks mainly include large,

international banks, but smaller Swedish and foreign banks are also included. The analysis of these loans is of interest because it is possible to investigate if the turnover volume of and interest rates for loans are dependent on the counterparty in question. It can also provide guidance about whether Stibor's level is in accordance with market pricing. Appendix 1 describes the data that refer to the turnover volumes and interest rates for unsecured interbank loans.

The analysis of foreign exchange swaps is based on a large sample of counterparties to the Stibor banks' treasury departments. Since the organisations of the banks are structured differently, the sample of counterparties varies from one bank to the next. Some of the banks' treasury departments have both governmental authorities and non-financial companies as counterparties, while others exclusively have banks as counterparties. It is reasonable to include several types of counterparties, in addition to banks, in the analysis since the pricing of foreign exchange swaps does not have the same clear link to the counterparty's creditworthiness as the pricing of an unsecured loan. This means that the pricing of foreign exchange swaps is more comparable to Stibor regardless of the counterparty. However, all transactions with intra-group counterparties have been excluded since these can be subject to internal subsidies. Two of the banks' treasury departments have only executed intra-group foreign exchange swaps, which mean that these banks are not included in the data set at all. The sample of counterparties has also been adjusted to prevent the transactions between Stibor banks from being counted twice.

TICK DATA FROM THE SUBMISSION PROCESS

The Riksbank ordered the other data set from Thomson Reuters in May 2012. This data set serves as a basis for the analysis of the banks' behaviour and Stibor submissions when Stibor is being set. The data set consists of the submissions the Stibor banks made daily for each maturity that Stibor was set for during the period January 1997-July 2012. It consists of per-second observations of the banks' submissions between 10:45 a.m. and 11:00 a.m. every day that Stibor was set.[20] The data of the banks' submissions is presented in Appendix 1. Because the data is not complete for the period 1997-2001, the analysis is based on the data from 2002-2012.

3.2 Analysis of the market for unsecured loans between banks

This section analyses the turnover volume of unsecured interbank loans during the period 2007-2011. The aim is to analyse if it is possible to verify Stibor using

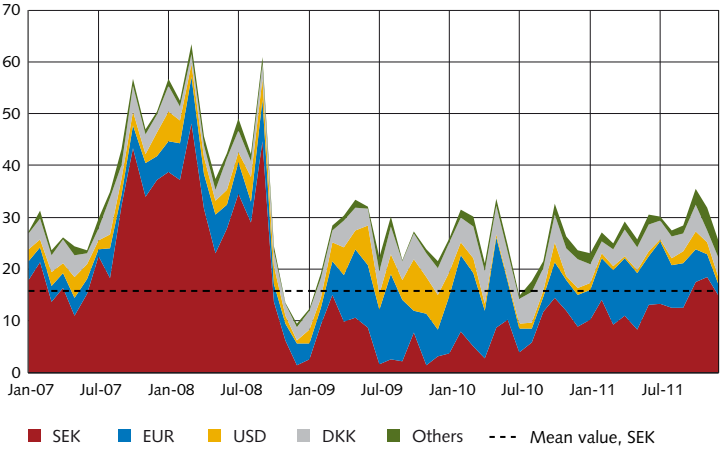
20 In reality observations are included that fall outside of this interval since the banks in some cases have submissions before and after this time span.

traded interest rates, i.e. interest rates that were used for actual raised loans. The analysis is first limited to loans between the Stibor banks. It is then expanded to also include loans to the Stibor banks from a larger sample of banks. Another type of unsecured loans is the banks' issued certificates in Swedish krona. This market has not been analysed, however, since it has had very low liquidity for a time (see the box Market for Bank Certificates).

TURNOVER VOLUMES OF LOANS BETWEEN THE STIBOR BANKS[21]

The volume of unsecured loans in Swedish krona between the Stibor banks has been relatively low (see Chart 2). During the period 2007-2011, the average daily turnover volume was 16 billion Swedish krona, which can be compared to 28 billion Swedish krona in repurchase agreements for the same banks.[22] The number of loans per day has also been low – only four per day on average (see Chart A1). For 121 of the 1,263 days the analysis is based on, no such transactions were executed at all (see Chart 3).

Chart 2. Currency breakdown of the Stibor banks' unsecured loans from one another
SEK billion

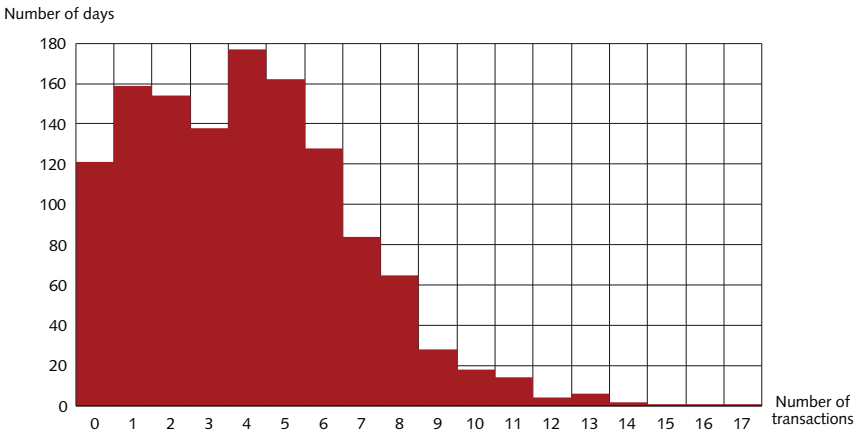


Note. The chart refers to the average daily turnover volume per month.
Source: The Riksbank

21 All charts that here refer to turnover volumes are also presented in Appendix 1 as the number of transactions.

22 Source: The Riksbank's SELMA data where the sample has been limited to the Stibor banks' repurchase agreements and reversed repurchase agreements with one another and adjusted for double counting of transactions.

Chart 3. Distribution of the daily number of unsecured loans in Swedish krona between the Stibor banks



Source: The Riksbank

The turnover volumes of unsecured loans between the Stibor banks were heavily influenced by the financial crisis that broke out in 2008. After having been around 35 billion Swedish krona during the first three quarters of 2008, the average daily turnover volume fell to 7 billion Swedish krona during the last quarter of the year (see Chart 2). This decrease followed the filing for bankruptcy protection by the American investment bank, Lehman Brothers, in September 2008. This led to a confidence crisis in the global banking system, which in turn resulted in a sharp increase in the risk valuation uncertainty. Banks all over the world, and thereby even the Swedish banks, had difficulty securing funding and managing their liquidity on the financial markets, which was reflected in decreased turnover volumes. To counteract this uncertainty, the Riksbank provided extraordinary lending corresponding to almost 400 billion Swedish krona during the period 2008-2010 to the monetary policy counterparties including the restricted monetary policy counterparties, which includes all of the current Stibor banks. These loans caused the risk premiums on the Swedish interbank market to fall. The extraordinary loans meant that the banks to a lesser degree needed to balance their liquidity among themselves.

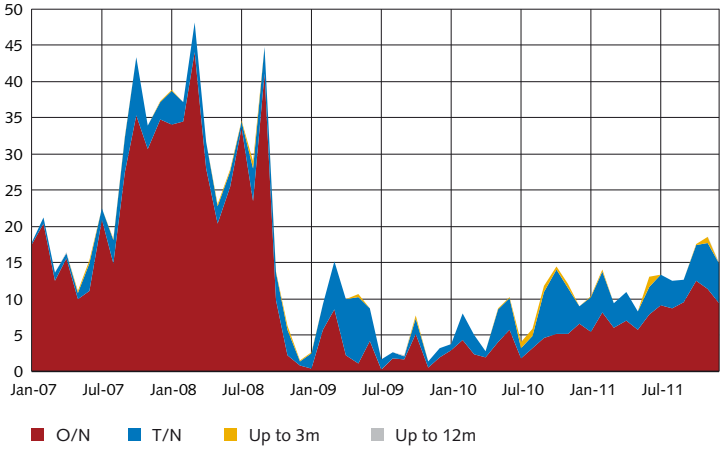
When the Riksbank's last extraordinary loan matured in October 2010, the turnover volume in Swedish krona rose again. This is a sign that the banks since then had once again begun to balance their liquidity in Swedish krona via deposits and loans between themselves. Even if the turnover volumes have not risen to the pre-crisis levels, they have continued to grow slowly since 2010.

It is also possible to see the effects of the financial crisis on the turnover volume of unsecured interbank loans in foreign currency. In contrast to the turnover volume in Swedish krona, however, the turnover volumes in euro and dollar rose

during the financial crisis. An explanation to this is that the banks at that point needed to have larger liquidity reserves in these currencies. The lack of confidence and security in the global banking system meant that the banks' access to funding in euro and dollar was severely limited. In order to manage their short-term cash outflows in euro and US dollar the banks needed to increase their liquidity reserves in these currencies, in part by borrowing from central banks' extraordinary facilities, including the Riksbank. This also applied to the Swedish banks. As a result, liquidity management in these currencies increased, which was reflected in the slightly higher turnover volume of unsecured loans between the Stibor banks in 2009 and 2010 (see Chart 2).

The maturity breakdown of the turnover volumes clearly reflects that the market for unsecured interbank loans is primarily used to balance liquidity between the banks and not as a source of funding. This type of liquidity balancing normally takes place via loans with the shortest maturities as a kind of last resort so the banks do not need to borrow or place liquidity in the Riksbank's standing borrowing and lending facilities. The turnover volume of loans in Swedish krona between the Stibor banks has been concentrated to the shortest maturities, O/N and T/N (see Chart 4). O/N loans were also dominant during the entire period in terms of both turnover volumes and number of transactions per day (see Chart A2). However, there were days when even no loans with the shortest maturities were made. The percentage of days when no T/N loans were made reached as much as 42 per cent (Table A5). The occurrence of days without any transactions was concentrated to the period September 2008 to the end of 2010 when the turnover volume and the issuance of loans were very low (see Chart 4 and Chart A2). This period coincides with the Riksbank's extraordinary loans. Both before and after this period the occurrence of loans with the maturities O/N and T/N was higher. For example, loans with a maturity of T/N were made on 75 per cent of the days during the period November 2010 to December 2011 (Table A7).

Chart 4. Maturity breakdown of the Stibor banks' unsecured loans in Swedish krona from one another
SEK billion



Note. The chart refers to the average daily turnover volume per month.
Source: The Riksbank

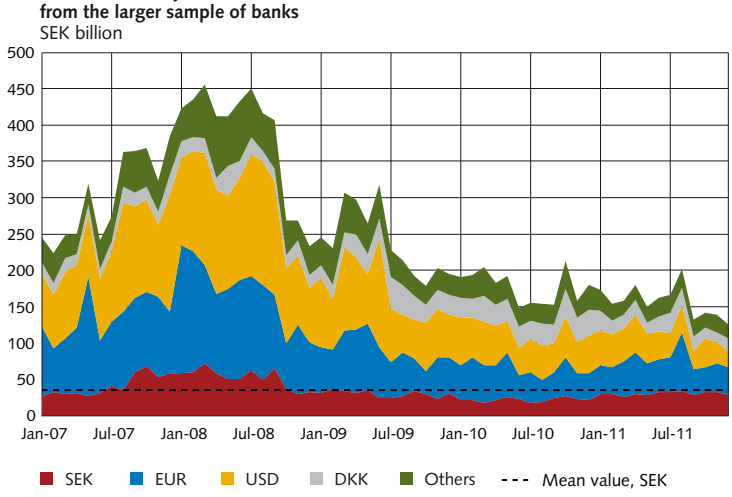
In summary, the analysis shows that the market for unsecured interbank loans between the Stibor banks is illiquid, particularly for the longer maturities for which Stibor is set. There are few possibilities for being able to set and evaluate Stibor using traded rates for such loans. In practice it is only possible to do this for the maturities O/N and T/N.

TURNOVER VOLUMES OF LOANS TO THE STIBOR BANKS FROM THE LARGER SAMPLE OF BANKS

The average daily turnover volume has been higher when a larger number of counterparties than only the Stibor banks are included (see Chart 5).[23] The average was 35 billion Swedish krona, spread out over an average of 95 transactions a day (see Chart 6 and Chart A4). There were also no days in this sample of counterparties when no loans in Swedish krona were made. The turnover volume, however, was still significantly lower than the corresponding daily turnover volume of repurchase agreements in Swedish krona, which during the same period totalled approximately 140 billion Swedish krona.[24]

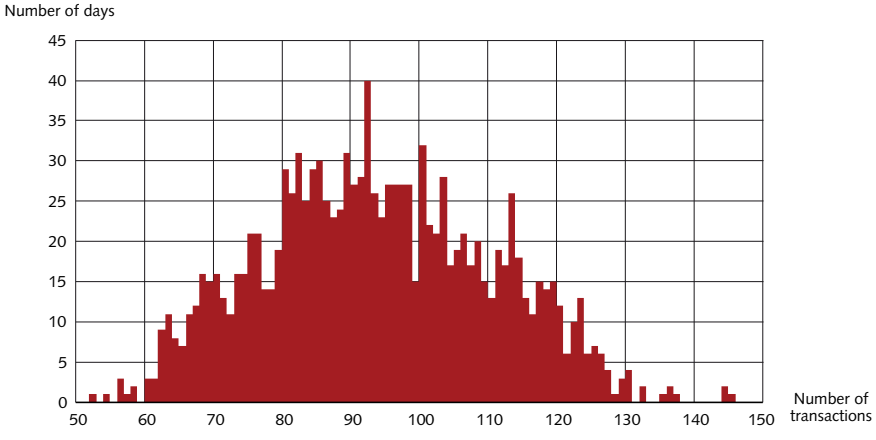
23 This sample contains, in addition to the Stibor banks, both large international banks and smaller Swedish and foreign banks.
24 Source: The Riksbank's SELMA data where the sample has been limited to the Stibor banks' repurchase agreements and reversed repurchase agreements, adjusted for the double counting of transactions with one another.

Chart 5. Currency breakdown of the Stibor banks' unsecured loans in Swedish krona from the larger sample of banks



Note. The chart refers to the average daily turnover volume per month.
Source: The Riksbank

Chart 6. Distribution of the daily number of unsecured inter-bank loans in Swedish krona to the Stibor banks from the larger sample of banks



Source: The Riksbank

The currency breakdown of the Stibor banks' unsecured loans from the banks in the larger sample differs significantly from when only the loans between the Stibor banks are taken into consideration. The occurrence and volumes of loans in euro and dollar are significantly larger when considering the larger sample of counterparties (see Charts 5 and B4). This is reasonable since a large number of counterparties in the larger sample are foreign and international banks with liquidity management primarily in foreign currency.

The effects of the financial crisis that started in 2008 are also clearly visible in the turnover volumes of transactions in the larger sample (See Chart 5). However, it is possible to identify a few differences in this data compared to the data from when only the loans between the Stibor banks are taken into consideration. In the previous sample, the turnover volumes in euro and US dollar increased after the financial crisis in 2008. In the larger sample, both the turnover volumes and the occurrence of these transactions instead fell in conjunction with the financial crisis (See Charts 5 and B4). This is probably due to the fact that banks on the international capital markets became less willing to lend euro and dollar during the crisis. They instead chose to keep their liquidity on their own balance sheets in order to be able to cover their short-term cash outflows in these currencies.

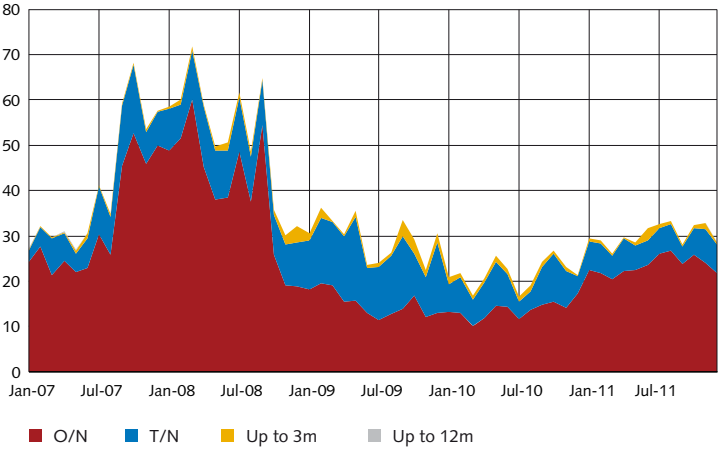
Another difference compared to the previous sample is that the increase in the total turnover volume of unsecured interbank loans was not as clear in recent years. Even if the numbers of loans in Swedish krona and the turnover volumes have increased, the loans in foreign currency have not returned to the pre-crisis levels. One explanation for this is that the banks use fewer unsecured loans for funding and to balance liquidity. Several reviews by foreign authorities and organisations show that secured funding has become more important in the global banking system.[25]

Just like in the analysis of the turnover volumes for loans in Swedish krona between the Stibor banks, the statistics from the larger sample also show that unsecured interbank loans primarily serve as a means to balance liquidity. The turnover volumes and occurrence of loans have been concentrated to the shortest maturities, O/N and T/N. Such loans were made basically every day, even taking into consideration the period 2008-2010 when there was a financial crisis and the Riksbank had provided extraordinary lending (see Tables B8-B10). This is not surprising since many banks that are not members of the Stibor panel were forced to deposit surplus liquidity with the Riksbank's monetary policy counterparties, which include the Stibor banks, since these counterparties are the only parties with direct access to the Riksbank's fine tuning operations where all surplus liquidity in Swedish krona is placed at the end of the day.

The turnover volumes and occurrence of loans with maturities up to three months, however, have been significantly larger in the larger sample of counterparties than when the sample is limited to the Stibor banks (see Chart 7 and Table A8). For example, loans with a one-month maturity were made on almost half of the days during the observed period. Even loans with a one-week maturity were made almost every day.

25 See, for example, HM Treasury (2012) and Juks (2012).

Chart 7. Maturity breakdown of the Stibor banks' unsecured loans in Swedish krona from the larger sample of banks
SEK billion



Note. The chart refers to the average daily turnover volume per month.
Source: The Riksbank

The analysis shows that the market for interbank loans to the Stibor banks from a larger sample of banks is more liquid than when the counterparties are limited to the banks on the Stibor panel. This can be because of the Stibor banks' unique negotiation position as primary monetary policy counterparties. Furthermore, liquidity on the market is low for maturities greater than three months. Even in terms of transactions with a larger sample of counterparties, there are for these reasons few possibilities to set and evaluate Stibor from the rates for actual loans.

INTEREST RATES ON THE MARKET FOR UNSECURED LOANS BETWEEN STIBOR BANKS

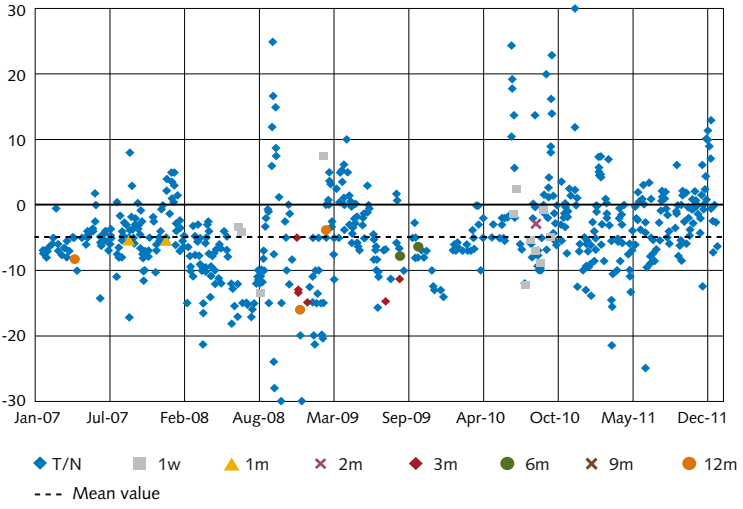
Stibor is different than a traded interest rate. While a traded rate is a rate that two parties have actually agreed upon for a loan, Stibor is defined as average offered rates.[26] In addition, Stibor is set at a specific point in time while other rates are set on a continuous basis and can therefore reflect different information. In this section, Stibor is compared to traded rates, more specifically the rates that applied to unsecured interbank loans in Swedish krona between the Stibor banks and to unsecured interbank loans to the Stibor banks from the larger sample of banks.

The interest rates for loans between the Stibor banks on average have been around 5 basis points lower than Stibor (see Chart 8). The differences between the traded rates and Stibor have also been evenly distributed around this average (see Chart 9). The deviation from Stibor can be explained by the fact that Stibor

26 The definition of Stibor is discussed in more detail in Chapter 2.

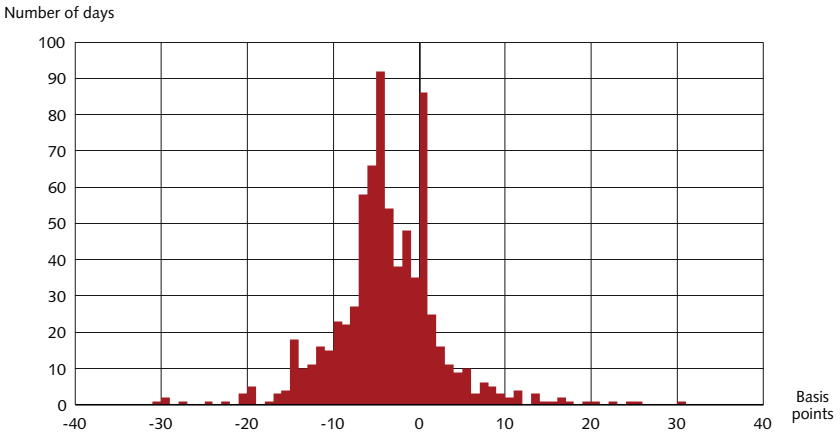
should correspond to an offered rate for lending, not a traded rate. The Stibor agreement states that the Stibor banks' offered rates for deposits should be 12 basis points lower than the offered lending rate. Given that the difference between offered deposit and lending rates also applies to actual loans on the interbank market, the rates for actual issued unsecured loans in Swedish krona between the Stibor banks were almost in the middle of the lending and deposit rates. This is justified since the lender and borrower normally agree on an interest rate after a negotiation where the lender has incentive to lend at a high rate and the borrower has incentive to borrow at a low rate. The compromise in the negotiation therefore often leads to an agreement for a rate that is somewhere in between the offered deposit and lending rates.

Chart 8. Difference between Stibor and the interest rates for unsecured loans in Swedish krona between the Stibor banks
Basis points



Note. The interest rates were calculated as a weighted average of the daily transactions. Each rate has been multiplied by a weight based on the transaction volume as a share of the total turnover volume during the day.
Source: The Riksbank

Chart 9. Distribution of differences between Stibor and the interest rates for unsecured loans in Swedish krona between the Stibor banks



Note. The interest rates were calculated as a weighted average of the daily transactions. Each rate has been multiplied by a weight based on the transaction volume as a share of the total turnover volume during the day.
Source: The Riksbank

It is possible to identify two periods during which the deviations from Stibor were larger than usual. The first is the third quarter of 2008 and the second is around October 2010. These observations coincide with the Lehman Brothers' filing for bankruptcy protection and the maturity date of the larger portion of the Riksbank's extraordinary loans, respectively.

As mentioned in the previous section, the application by Lehman Brothers for bankruptcy protection triggered a confidence crisis and increased uncertainty in the global banking system. This was reflected in rising risk premiums on the financial markets, including the interbank market. The deviations in the traded rates for unsecured loans in Swedish krona were probably also a consequence of the increased uncertainty in the valuation of risks in the banking system during the latter part of 2008. As a result, the Stibor banks did not know for sure how they should value risks such as credit risk with regard to their counterparties, which resulted in a greater deviation of traded rates from Stibor. The cause was the wider spread in interest rates for loans from different counterparties.

The Riksbank's extraordinary loans were granted at the end of 2008 to the monetary policy counterparties including the restricted monetary policy counterparties. In 2010 the Riksbank gradually allowed these loans to mature. The last major maturity date for the loans occurred on 6 October 2010, at which time around 100 Swedish krona billion matured. In conjunction with this, some risk premiums on the Swedish interbank market rose again since the banks again needed to negotiate with one another more frequently to balance liquidity between them. This resulted in a liquidity premium and uncertainty about the

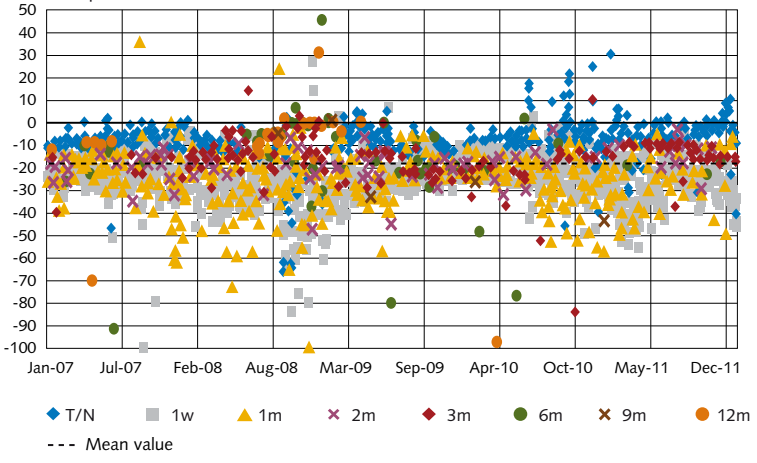
proper size of that premium. At first the banks were uncertain under which conditions it would be possible to balance liquidity. Therefore the traded rates also varied significantly during this period, which could explain the deviations from Stibor around October 2010 in Chart 8.

In summary, the comparison between Stibor and the rates for loans between the Stibor banks indicate that Stibor's levels are reasonable. In the empirical evaluation there are no signs of any manipulation of Stibor. However, as stated previously, it is difficult to verify Stibor using market prices for longer maturities.

INTEREST RATES ON THE MARKET FOR UNSECURED LOANS TO STIBOR BANKS FROM A LARGER SAMPLE OF BANKS

The interest rates for unsecured loans to Stibor banks from a larger sample of banks have on average been 18 basis points lower than Stibor (see Chart 10).[27] The differences have been relatively evenly distributed around the average even if to some extent they have tended to be lower than the average. In conjunction with the outbreak of the financial crisis in 2008 and the maturity date of the Riksbank's extraordinary loans in October 2010, the interest rates deviated more than normal, just like the interest rates on loans between the Stibor banks (see Chart 11).

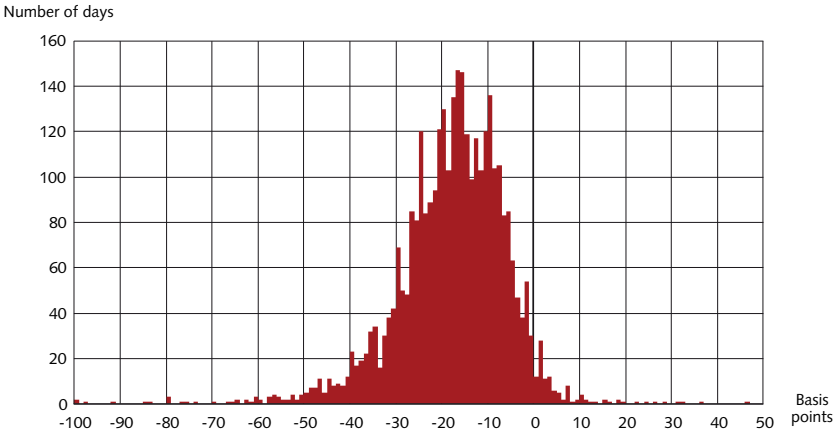
Chart 10. Difference between Stibor and the interest rates for unsecured loans in Swedish krona to the Stibor banks from the larger sample of banks
Basis points



Note. The interest rates were calculated as a weighted average of the daily transactions. Each rate has been multiplied by a weight based on the transaction volume as a share of the total turnover volume during the day.
Source: The Riksbank

27 The difference between the rates that applied between the Stibor banks are statistically significant.

Chart 11. Distribution of differences between Stibor and the interest rates for unsecured loans in Swedish krona to the Stibor banks from the larger sample of banks



Note. The interest rates were calculated as a weighted average of the daily transactions. Each rate has been multiplied by a weight based on the transaction volume as a share of the total turnover volume during the day.
Source: The Riksbank

Even when looking at the larger sample of counterparties, it is reasonable that the traded rates were lower than Stibor, since Stibor should reflect an offered and not a traded rate. The fact that the traded rates have been lower than when the sample of counterparties only includes the Stibor banks is most likely due to the fact that the Stibor banks' business relationships with counterparties that are not on the Stibor panel are different than the business relationships between the panel banks.

As mentioned in the previous section, unsecured interbank loans are primarily used to balance liquidity. The Stibor banks are all primary monetary policy counterparties to the Riksbank and therefore play a central role in the management of liquidity in Swedish krona. When a bank that is not a primary monetary policy counterparty to the Riksbank has a surplus or deficit of liquidity in Swedish krona, it is reasonable for it to use one of these counterparties to raise a loan or make a deposit since the bank that is not a primary monetary policy counterparty faces a risk that it might not be able to borrow or deposit Swedish krona with another bank. Due to its unique position, the primary monetary policy counterparty therefore often has an advantage in the negotiation of the interest rate that will apply to the loan or deposit. This counterparty has room in its negotiations to offer a relatively high rate for loans and a relatively low rate for deposits compared to non-primary monetary policy counterparties. This negotiation advantage means that it is not surprising that interest rates for the

Stibor banks' loans from the larger sample of banks have been somewhat lower than the interest rates that applied between the Stibor banks.

In summary, there is a difference between the interest rates for the Stibor banks' loans from the larger sample of banks and the rates that applied between the Stibor banks. However, there are grounds that justify this difference. This analysis therefore also indicates that Stibor's levels are reasonable.

Market for bank certificates

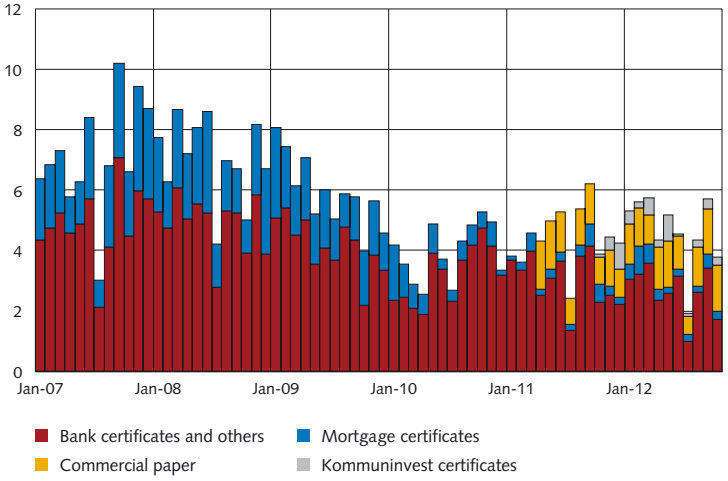
This box describes the liquidity on the market for bank certificates in Swedish krona, which the Swedish banks also use in their short-term funding.

Bank certificates are closely related to the definition of Stibor since they are a type of unsecured loan. In contrast to interbank loans, however, bank certificates are issued securities. This means that the lender, i.e. the party investing in the certificate, has the option of selling the security before it matures and thereby divesting the risk that is linked to the holding. This is not possible with a normal unsecured interbank loan since it cannot be sold in this manner. This difference means that bank certificates can be expected to be traded at slightly lower rates than interbank loans since the liquidity premium reasonably is lower when the lender does not need to tie up money for the entire term of the loan. However, since bank certificates have other similarities with the Stibor definition, it may still be of interest to compare the rates for bank certificates with the benchmark rate. In order for this type of comparison to be possible and reliable, however, there needs to be sufficient liquidity in the market for bank certificates in Swedish krona.

As explained in the box Funding of Swedish Banks, certificates are an important part of the banks' funding. However, this applies primarily to certificates in foreign currency while funding from certificates in Swedish krona only represents 1.5 per cent of the banks' total funding. Chart B4 shows that the turnover volumes on the market for bank certificates in Swedish krona in general has been very low. In 2010-2011 the average daily turnover volume was 3 billion Swedish krona, which includes both issues and transactions on the secondary market. This can be compared to the corresponding turnover volume for the market for unsecured loans with the Stibor banks, which is often considered to be illiquid. On average the volume was 10 billion Swedish krona per day during the same period (see Chart 2). The category "Bank certificates and others" in Chart B4 also includes not only issuers in the form of banks but also credit market companies, local authorities and regions.

Historical data shows that the banks' use of certificates in Swedish krona in their short-term funding is limited and that the turnover volumes on the market for these types of certificates have been very low and decreasing over time.

Chart B4. Turnover volumes on the market for bank certificates in Swedish krona
SEK billion



Note. The chart refers to the average daily turnover volume per month. The data includes the turnover volume on both the primary market and the secondary market. In addition to banks' issued certificates, the turnover volume in the category "Bank certificates and others" can include certificates issued by credit market companies, local authorities and regions. However, this excludes certificates issued by mortgage institutions, the Riksbank and non-financial companies.
Source: The Riksbank's SELMA statistics

3.3 Analysis of the market for foreign exchange swaps

As described in the box Funding of major Swedish banks, 90 per cent of the Swedish banks' short-term funding consists of foreign currency, of which approximately one fourth is transformed into funding in Swedish krona via foreign exchange swaps. This means that the pricing of such swaps has a considerable impact on the interest rates for short-term interbank loans in Swedish krona, making them an appropriate starting point for the pricing and evaluation of Stibor, which should reflect the pricing of these types of loans. As described in Chapter 2, the Stibor banks also state that they use the prices of foreign exchange swaps when they set Stibor on a daily basis since their funding at the maturities in question often to a large extent consist of loans in the form of issued certificates in euro and dollar.

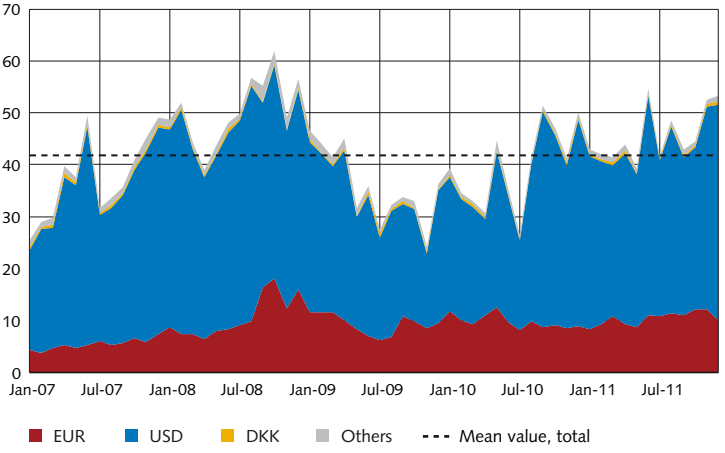
In this section the turnover volumes of foreign exchange swaps are analysed. This analysis serves in part as the groundwork for the assessment of the conditions for setting and evaluating Stibor based on traded market prices. The conditions for deriving an interest rate in Swedish krona from prices of foreign exchange swaps that is comparable to Stibor is also reviewed.

TURNOVER VOLUMES OF FOREIGN EXCHANGE SWAPS

The average daily turnover volume of the transactions by Stibor banks' treasury departments with foreign exchange swaps was 42 billion Swedish krona in 2007-2011 (see Chart 12). This can be compared to 171 billion Swedish krona when taking the Stibor banks' entire operations into account.[28] As previously mentioned, the treasury departments' transactions with foreign exchange swaps only include a smaller portion of the Stibor banks' total turnover volume of such swaps. Despite the limitation to the treasury departments' transactions, there have been daily transactions with foreign exchange swaps during the observed period (see Chart 13).

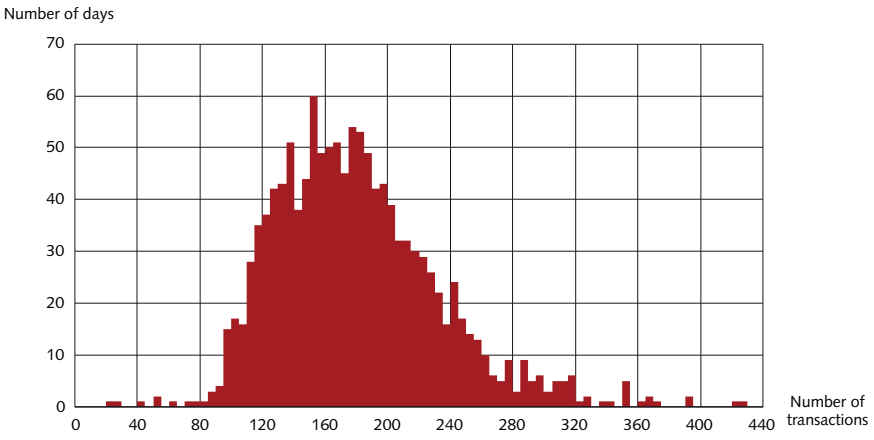
28 Source: The Riksbank's SELMA statistics.

Chart 12. Currency breakdown of the Stibor banks' foreign exchange swaps
SEK billion



Note. The Chart refers to the average daily turnover volume per month. Only foreign exchange swaps where Swedish krona is one of the currencies are included.
Source: The Riksbank

Chart 13. Distribution of the number of transactions with foreign exchange swaps executed by the Stibor banks



Source: The Riksbank

The turnover volumes are primarily concentrated in swaps that exchange Swedish krona for euro and dollar. This is reasonable since these currencies are the most important for the banks' funding in foreign currency. Foreign exchange swaps for dollar have been dominant, which reflects the Swedish banks' extensive use of short-term funding in dollar via issued certificates that were transformed into funding in Swedish krona through foreign exchange swaps.

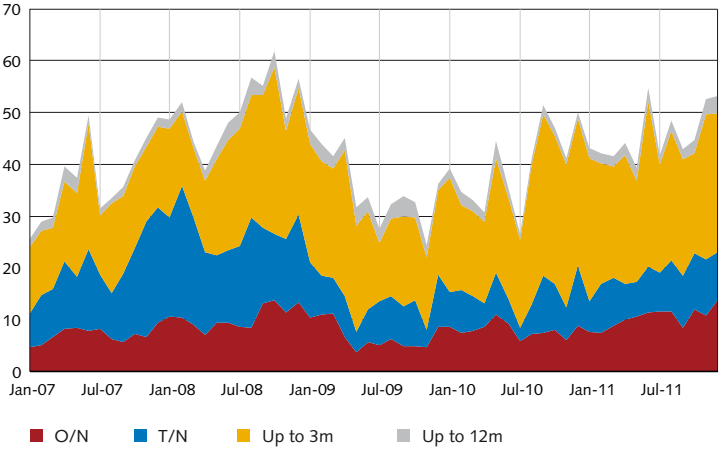
The development in the turnover volumes also indicates the major effects of the financial crisis in 2008. The turnover volume of foreign exchange swaps fell

both in dollar and euro in September 2008 when it became more difficult for the banks to gain access to market funding. At this point both the European Central Bank and the US central bank, the Federal Reserve, provided extra liquidity in euro and dollar to mitigate funding problems in the banking system. The Riksbank also provided liquidity in dollar. This also meant that the turnover volume was lower, which is visible in Chart 12. The daily number of transactions, however, remained at similar levels as before (see Chart A7).

The occurrence of transactions with foreign exchange swaps has been relatively high for all maturities (see Chart 14 and Table A11). Transactions took place for all maturities during at least half of the days in the observed period. For the maturities up to 6 months, the transactions occurred almost every day. The occurrence of transactions has also been independent of whether the period of the financial crisis and the period of extraordinary measures from the Riksbank are included (see Tables B11-B13).

The higher turnover volume of foreign exchange swaps, due to the banks' extensive use of funding in foreign currency, shows that there is frequent occurrence of traded prices that can be used to verify Stibor. There are also a number of market makers that continuously quote bid and ask prices for maturities up to one year on this market. The market makers undertake to trade at the prices they quote, which means that it is always possible to buy or sell, even if the order depth and the transaction costs can differ between maturities.

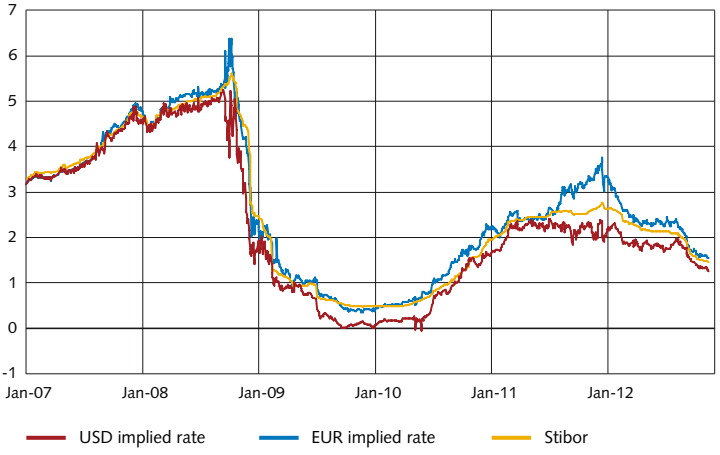
Chart 14. Maturity breakdown of the Stibor banks' foreign exchange swaps
SEK billion



Note. The chart refers to the average daily turnover volume per month. Only foreign exchange swaps where Swedish krona is one of the currencies are included.
Source: The Riksbank

Chart 15 shows the interest rates in Swedish krona that the prices of foreign exchange swaps in euro and dollar imply. It is possible to make several observations from the chart, which in addition to the two implied rates also shows Stibor for the three-month maturity. One observation is that Stibor previously correlated well to both of the implied rates. This corresponds to the Stibor banks' statement that they use their two implied rates when they set Stibor. However, since the distribution of euro and dollar in the banks' short-term funding differs between banks and since the banks, when applicable, use interest rates other than Libor and Euribor in the calculation, Stibor does not always equal the average of the two implied rates. Chart 15 confirms the banks' statements about how they set Stibor. However, it does not give an exact picture of the level at which Stibor should be since the implied rates should only be viewed as indicative since they are derived from incomplete information about the pricing of foreign exchange swaps.

Chart 15. Three-month Stibor and the rates implied by the foreign exchange swaps
Per cent



Note. "EUR implied rate" and "USD implied rate" are rates in Swedish krona that are comparable to Stibor. The implied rates are calculated using Libor and Euribor and USD/SEK and EUR/SEK swaps.
Sources: Reuters EcoWin, Bloomberg and the Riksbank

In summary, there is more frequent trade in foreign exchange swaps than interbank loans and the basis for setting and evaluating Stibor using the prices of foreign exchange swaps are therefore better. For a number of reasons it is, however, difficult to derive interest rates from the pricing of foreign exchange swaps. This is because there are no liquid interest rate and currency markets where transactions can be made continuously to immediately balance out any potential opportunities for arbitrage. There is also no common practice for storing information about what the prices of the foreign exchange swaps are based upon, i.e. the information about the interest rate for each currency and the forward and

spot prices of the currency pairs. This means that it is difficult to verify Stibor using this type of contract. The analysis that can be done is based on the comparison between Stibor and the rates in Swedish krona implied by the prices on foreign exchange swaps in euro and dollar. This indicates that Stibor is set within a reasonable interval even at slightly longer maturities

3.4 Analysis of the microstructure of the submission process for Stibor

This far the empirical evaluation has shown, among other things, that the conditions for the banks to set Stibor based on market prices and traded rates are limited. This means that it is important to have an appropriately structured submission process when setting Stibor. The submission process must be organised in such a manner that the Stibor banks have the proper incentives to make correct submissions, i.e. to submit interest rates that reflect the definition of Stibor.

This section analyses the microstructure of the banks' behaviour during the submission process when Stibor is set. First, the development of the Stibor submissions made by the banks over time is analysed. This analysis shows the spread between the Stibor banks' submissions and the relationship between the median of the submissions and Stibor, which is calculated as a mean. The changes the banks make to their submissions are then analysed, as well as the frequency with which the banks have been the first submitting bank.

THE BANKS' SUBMISSIONS IN RELATION TO THE FINAL STIBOR

There are several reasons why it is of interest to review the Stibor banks' submissions. The deviations between the submissions can indicate the extent to which they have made different assessments and the extent to which they have chosen to make very similar submissions. The review can also provide information about the distribution of the submissions around the mean and median.

During the period prior to the financial crisis in 2008, the deviations between the banks' Stibor submissions were relatively small, around 3 basis points. The submissions were also evenly distributed around the final Stibor rate (see Chart 16). During the crisis, however, the deviations between the submissions increased significantly. This development can have had several causes. One is that the pricing of risk became uncertain when confidence in the banking system was undermined. It was thereby reasonable that the banks to a greater extent had different opinions about how large the risk premiums were and thus what Stibor should be. During the financial crisis the banks' funding costs also differed. This meant that the banks' were justified in making different Stibor submissions since they faced different conditions in terms of the rates they could offer for loans.

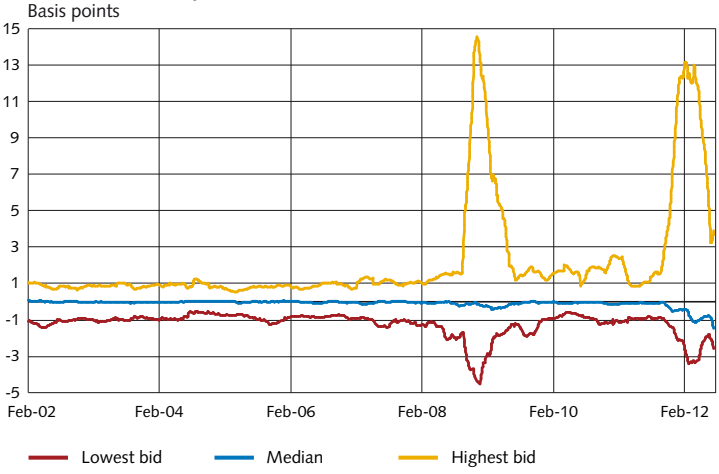
Despite the fact that the differences between the Stibor submissions increased during 2008 and 2009, the median of the submissions was not greatly affected. It remained in line with Stibor, which in contrast to the median should be the equivalent of an average of the submissions after the highest and lowest submissions had been removed. This was because there normally was only the occasional submission that deviated by being higher than the others. Since the highest and lowest values are removed, these submissions did not affect the final Stibor rate (see Chapter 2).

After the crisis in 2008-2009 the submissions have not been as evenly distributed as before. It is mainly the highest submissions that have fluctuated more than before, which is because the risk premiums were higher and more volatile during the period after the crisis. The median of the submissions, however, has remained in line with Stibor up until the end of 2011. At this point the highest submissions rose significantly once again and the median fell below Stibor. The reason for this was that more than one bank made a higher submission than the other banks, which drove the final Stibor rate up over the median of the submissions. For the first time during the studied period the median and the mean differed.

After RBS left the Stibor panel in April 2012, Stibor began to be calculated as an average without removing the highest and lowest submissions, as long as they did not differ from the second highest or second lowest submissions, respectively, by more than 25 basis points. This meant that the highest submission also affected the final Stibor rate, which meant that Stibor became even higher than the median of the submissions.

Chart 16. The highest, lowest and middle deviations of daily submissions from Stibor, three-month maturity [29, 30]

Basis points



Note. The deviation was calculated as a 60-day moving average of the daily deviations. This means that the data set has deviations greater than 20 basis points on some days.
Sources: Thomson Reuters and the Riksbank

CHANGES TO THE STIBOR BANKS' SUBMISSIONS

When reviewing the number of changes to the Stibor submissions during the period 2002-2012, it is possible to make a number of important observations. One observation is that the banks in general changed their submissions more frequently before the crisis than after (see Chart 17). One explanation for this is that during the crisis the banks agreed they would no longer have the option of borrowing or making deposits at each other's submissions. The previous possibility of conducting a transaction appears to have meant there was more of a reason for the banks to change their submissions. This can be interpreted as meaning that the banks were at that time more careful about the precision of their submissions. At the same time it is not possible to ignore that the banks could change their submissions to avoid transactions. In other words, the banks' faced incentives to change their submission to avoid loans or deposits at their submission.

Another observation is that the banks in general have changed their Stibor submissions more often during periods of stress. The clearest example of this is the number of changes in 2008 at the start of the financial crisis. The cause was the uncertainty in the pricing of risk during the financial crisis. The foreign bank, RBS, was the bank that changed its submissions the most in 2008 and in general

29 Three-month maturity is used as an example in this analysis. The reasoning related to this maturity is also representative of the other maturities.

30 It should be noted that the deviations have been higher than what is indicated by the average. The highest deviations over Stibor have been around 35 basis points while the lowest deviations under Stibor have been around 15 basis points.

during the studied period. This bank has no natural access to and use for liquidity in Swedish krona, which means that it can have less information about pricing of loans in Swedish krona than the other Stibor banks. This should reasonably have made it rather difficult for RBS to set Stibor and therefore caused it to change its submissions more frequently than the others.

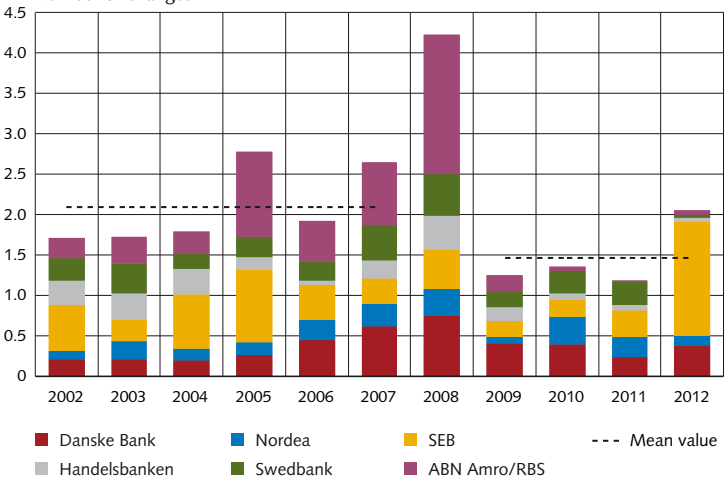
The data also shows that the banks' changes often occurred between 10:45 a.m. and 10:55 a.m. when they did not have the possibility of borrowing or depositing at each other's submissions. There were fewer changes during the remaining five minutes between 10:55 a.m. and 11:00 a.m. when it was possible to borrow and make deposits (see Chart 17 and Chart 18). Even if this is reasonable given the time spans, this observation indicates something important. It shows that the banks have often chosen to change their submission before the five minutes between 10:55 a.m. and 11:00 a.m. when it was possible to conduct transactions. This indicates that the banks face incentives not to deviate from one another in the submission process since they had reason to want to avoid transactions at their submissions, which would mean they had to burden their balance sheets with loans or deposits. Instead of making correct submissions, the banks face incentives to make the same submissions as all of the other banks. However, this does not necessarily mean that Stibor has been set at incorrect levels.

Finally, it can be noted that the changes to the submissions in general have been very small (see Chart 19). This can itself be interpreted as a good sign since it implies a certain degree of precision in the submission process. However, it should be noted that there have been significantly larger changes, which are shown in Chart 19, in terms of the change in the 75 per cent percentile.[31]

31 The 75 per cent percentile means the changes to submissions that belonged to the 25 per cent largest during the 60-day period for which the average is calculated.

Chart 17. Average number of changes to submissions between 10:45 a.m. and 10:55 a.m

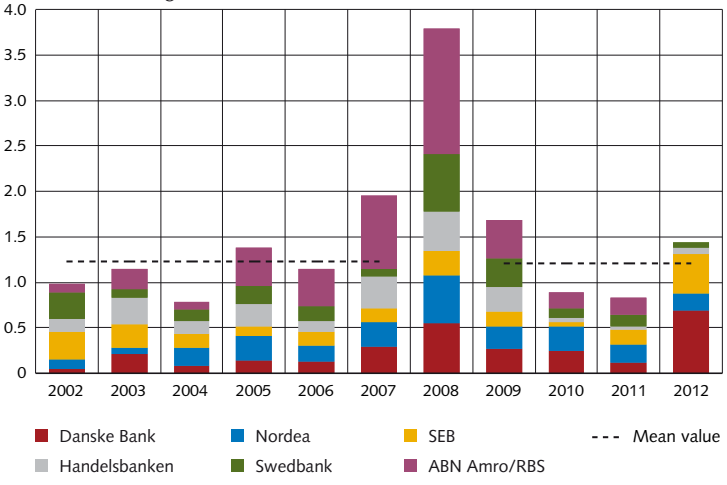
Number of changes



Note. RBS withdrew from the Stibor panel in April 2012, which can affect the data for this bank.
Sources: Thomson Reuters and the Riksbank

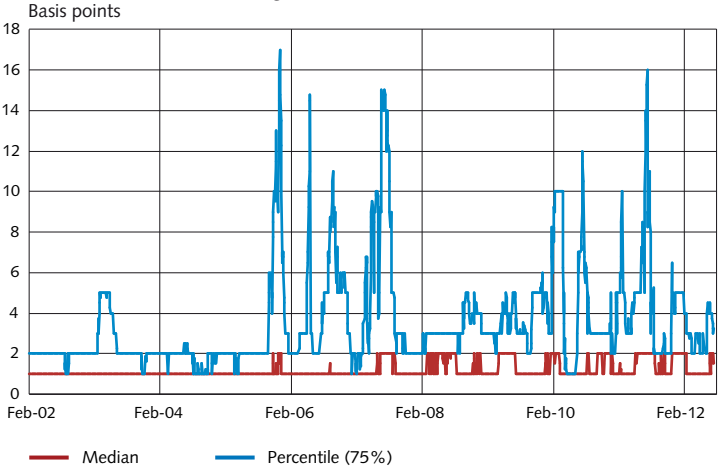
Chart 18. Average number of changes to submissions between 10:55 a.m. and 11:00 a.m

Number of changes



Note. RBS withdrew from the Stibor panel in April 2012, which can affect the data for this bank.
Sources: Thomson Reuters and the Riksbank

Chart 19. Distribution of changes to submissions
Basis points



Note. The calculations of the median and percentile are based on 60-day history of changes to submissions for all Stibor maturities. The changes are calculated as the difference between the highest and lowest submission per bank and maturity during one day.
Sources: Thomson Reuters and the Riksbank

FIRST BANK TO SUBMIT IN THE SUBMISSION PROCESS

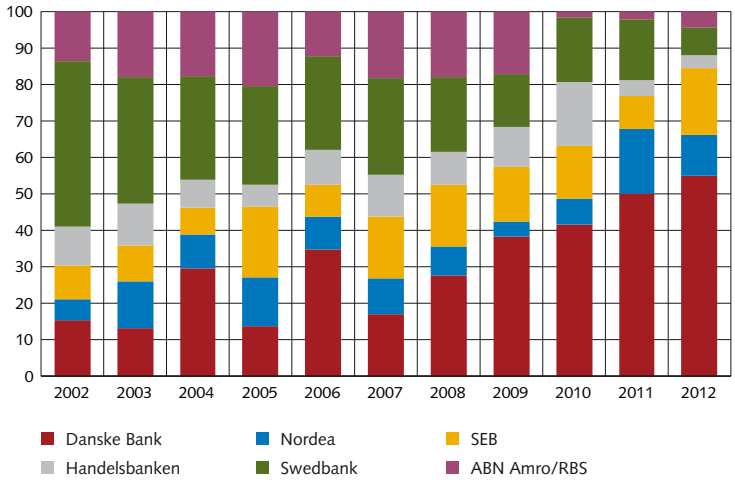
The Stibor bank that made the first submission in the submission process has varied over time, even if it has not been completely random (see Chart 20). The differences between the banks' different tendencies to make the first submission can have several causes. One is that the banks may have different internal procedures for how they set Stibor. For some reason, for example, it may be that one bank always makes its submission almost immediately after 10:45 a.m. while another bank's procedure is to make its submissions at 10:50 a.m.

Different behaviour can also be due to the banks' differing strategies in the submission process. The fact that the banks can see each other's submissions during the entire period 10:45 a.m.-11:00 a.m., leads to a potential strategy, for example, of signalling early where the submissions should be by making the first submissions. Another reason to make the first submissions could be that the bank is not uncertain, but rather has definitively decided which submissions it will make. In this case there is no reason to wait until the other banks have made their submissions. The fact that Danske Bank and Swedbank historically have often been the first to make their submissions can therefore have different explanations (see Chart 20).

There have also been banks that consistently have not been the first to make their submissions, namely Handelsbanken, Nordea, SEB and RBS (previously ABN Amro). This can be an indication of a strategy to make their submissions in line with the other banks instead of making their submissions independently of the others. This strategy has also been possible since the banks have been able to see

each other's submissions during the entire submission process. Given the open submission process and the previous opportunity for the banks to borrow and make deposits at each other's submissions, there has been an incentive for the banks to make similar instead of correct submissions that they actually can offer for loans in accordance with the definition of Stibor. In this way the banks have been able to avoid loans and deposits.

Chart 20. Percentage of days each bank made the first submission
Per cent



Note. RBS withdrew from the Stibor panel in April 2012, which can affect the data for this bank.
Sources: Reuters and the Riksbank

In summary, the submission process for Stibor is not fit for its purpose. The open submission process opens the door for strategic submissions and enables the Stibor banks to influence each other's submissions during the submission process. There is a risk that this will result in a behaviour in that the Stibor banks in the end will all make the same submissions or submissions that are similar to one another instead of each individual Stibor bank making submissions that it believes to be correct.

4 Deficiencies in the Stibor framework

In the results of the empirical evaluation there are no signs of any manipulation of the Stibor benchmark. However, the analysis shows that it is difficult to derive Stibor from market pricing, particularly for longer maturities. This is because the Swedish banks' funding in short-term loans in Swedish krona is limited. There is thus little interbank trade in unsecured loans. At the same time, it is difficult to derive interest rates from foreign exchange swaps. The analysis in this report also shows that the framework for Stibor contains a number of deficiencies that risk leading to inadequate incentives and inappropriate processes for determining Stibor. This could undermine confidence in the benchmark rate and lead to inefficient pricing of risk in the financial system and to distortions in the allocation of capital in the economy. This chapter contains a review of the deficiencies identified and their potential consequences.

LACK OF RESPONSIBILITY

As described in Chapter 2, the five Stibor banks are jointly responsible for the agreement regulating how the benchmark rate is determined. There is thus no individual agent responsible for the agreement, and which can be held accountable in questions that concern the structures surrounding Stibor. Nor is there any individual agent who can make decisions on changes in the agreement on how Stibor is determined, while at the same time the banks have no reason to take individual responsibility for shortcomings in the agreement.

LACK OF GOVERNANCE AND CONTROL

As no individual agent has clear responsibility for Stibor, there is no clear structure for ensuring that confidence in the benchmark rate is maintained. For instance, there is no organisation to assess the banks' compliance with the Stibor agreement. Furthermore, there is no organisation that can deal with questions or complaints regarding Stibor from the general public and other interested parties. For example, it is unclear where a bank should turn if it wants to become a participant of the Stibor panel.

Moreover, the Stibor framework does not clearly show how to act if a bank is misbehaving or if there are internal conflicts of interest when determining Stibor within a bank. All of the Stibor banks have allocated the task of determining Stibor to their respective treasury departments. Even if this is so, there is no overall regulatory framework for how the banks should organise an internal function to

determine Stibor in a way that avoids the wrong incentives arising in the process for determining the rate.

LACK OF TRANSPARENCY IN THE PROCESS FOR DETERMINING STIBOR

The Stibor agreement is not public. Other than the information presented on the Nasdaq OMX website, there is little information available with regard to what Stibor is and how it is determined. It is thus only the Stibor banks themselves that have full insight into how Stibor is determined. In this way, Stibor differs from benchmark rates on other markets, where information on the framework is made public. The lack of publicly available information makes it difficult for the general public and other agents to assess and understand the benchmark rate. This means that public authorities must make a formal request for information in order to investigate Stibor.

Interviews with the Stibor banks also show that there is scope to interpret Stibor in different ways. For example, there has been a discussion among the banks as to whether Stibor should reflect an average funding cost or a marginal cost for unsecured interbank loans in Swedish krona. Such a lack of clarity risks leading to inefficiency when determining the benchmark rate.

DIFFICULT TO VERIFY STIBOR

The Swedish banks mainly use loans in foreign currencies for their short-term wholesale funding. This means that it is difficult to derive Stibor for most maturities on the basis of the interest rates and prices traded. As illustrated in Chapter 3, the banks make little use of unsecured interbank loans in Swedish krona; such loans are primarily regarded as a means of balancing liquidity between the banks. This is reflected in the fact that the turnover primarily concerns the shortest maturities, O/N and T/N. The banks' use of funding through bank certificates in Swedish krona, which could also be used to derive Stibor, is limited, too.

The banks use foreign exchange swaps to convert their funding in foreign currency to Swedish krona. The pricing of foreign exchange swaps could thus comprise a suitable starting point for determining and evaluating Stibor. The analysis in Chapter 3 shows, however, that it is not entirely clear how this can be achieved, as not all of the information on pricing is readily available.

This means that there is no starting point for the pricing of actual transactions when Stibor is to be verified for longer maturities than T/N. The lack of information on how the banks' Stibor submissions can be derived is thus a particularly tangible deficiency. For example, no information is available on the allocation between different interest rates and currencies used as a basis by the banks when they

make their submissions. This is partly because no practice exists for storing information on the pricing of foreign exchange swaps.

FEW BANKS ON THE STIBOR PANEL

The Swedish financial market is relatively small with few banks, and the Stibor panel currently consists of only five banks (see Chapter 2). The fact that there are so few Stibor banks entails a risk of collaboration between the banks when Stibor is being determined and that the statistical basis for calculating the benchmark rate is limited.

At the same time, it is not only the Stibor banks that have large balance sheets in Swedish krona and an extensive liquidity management in this currency. Many of these other banks also use Stibor when pricing financial contracts and have financial contracts linked to the benchmark rate in their risk management. This indicates that there may be more market participants who would have an interest in participating in the panel.

INADEQUATE INCENTIVES IN SUBMISSION PROCESS WHEN STIBOR IS DETERMINED

The submission process for determining Stibor should be designed so that the banks in the Stibor panel have strong incentives to make submissions that they are actually prepared to offer for loans according to the definition of Stibor, that is, correct submissions.[32] It is likely that the banks have such incentives now, as it would be directly detrimental to confidence to make clearly incorrect submissions. Nevertheless, there are a number of deficiencies in the submission process that have a negative effect on the incentive structure. These deficiencies can be divided into two parts.

Firstly, the submission process is open, which means that the Stibor banks can see one another's submissions during the process. They thus cannot be said to be acting independently of one another when making their submissions. The open process gives the banks the incentive to make submissions that are similar or exactly the same. As long as no bank makes a completely misleading submission, there is namely no evident reason for the banks to deviate significantly from one another even if their assessments were to differ. On the contrary, deviations may send out unwanted signals to other market agents, for instance, if their own bank's funding costs have increased. Previously, when the submission process contained an opportunity for the banks to trade at one another's submissions, they had an even greater incentive to make the same submissions. Otherwise they might risk requests regarding loans and deposits from other banks in the panel. The analysis

32 As shown in Table 3, the submission process involves each bank in the Stibor panel stating on each banking day what interest rate they can offer to one of the other banks in the panel for loans in Swedish krona without collateral at the maturities tomorrow-next (T/N), 1 week and 1, 2, 3, 6, 9 and 12 months.

in Chapter 3 also shows that the banks' submissions have previously deviated very little from one another.

Secondly, the banks are not bound by the submissions they have made. Historical data in Chapter 3 shows that the earlier possibility for the banks to trade at one another's submissions led to more changes in the submissions, which can be interpreted to mean that the banks were more particular about the precision of the submissions. At the same time, it is not possible to ignore the fact that the banks had the opportunity to change their submissions to avoid trade (see Chapter 2). In other words, the banks have never been obliged to trade at their submissions.

LARGE TRADING UNITS AND MANY MATURITIES

The financial crisis led to an increase in the uncertainty over the banks' assessments of one another's risk premiums and to their risk premiums differing from one another more than before. This meant, for instance, that the banks no longer wanted to keep the possibility to lend or accept deposits at their submissions; as such loans and deposits would burden their balance sheets too much. The problem was partly due to the size of the trading units the Stibor submissions were made for and the number of maturities for which Stibor should be determined.

The submissions the Stibor banks make refer to loans of 500 million Swedish krona for all maturities up to 6 months and 100 million Swedish krona for maturities of 9 and 12 months. Large trading units and many maturities mean that the banks need to place a large share of their balance sheets at the disposal of the trading at these submissions. Moreover, loans and deposits with longer maturities lead to larger credit and liquidity risks for the banks. Apart from the fact that they can affect the incentives for trading, the possible risk exposures entailed in the current trading units and number of maturities risk making smaller banks less interested in participating in the Stibor panel. Small banks do not have the capacity to manage risk exposures of the same magnitude as the banks in the present Stibor panel.

Moreover, the banks do not use all of the maturities for which Stibor is determined to a great extent when pricing financial contracts, which is described in Chapter 2.

LACK OF TRANSACTION-BASED INTEREST RATE FOR THE MATURITY T/N

Many international benchmark rates have 1 week as the shortest maturity.[33] The interest rates for the shortest maturities, O/N or T/N, or both, were instead often

33 It should be noted that the British Wheatley inquiry proposes that in the longer run, Libor should not be determined for the maturity O/N.

calculated on the basis of the pricing of actual transactions. In Sweden, there is no such transaction-based interest rate. Instead, Stibor T/N comprises the benchmark for the shortest maturities. This means that there is a lack of information on the pricing of actual transactions for the shortest maturities on the Swedish fixed-income market. At the same time, the empirical analysis in Chapter 3 shows that interbank loans are normally made at the shortest maturities daily, which means that there is often a basis for calculating a transaction-based interest rate.

5 Conclusion – Stibor needs to be reformed

Stibor has considerable significance for the pricing of loans and other financial contracts in Swedish krona. At the same time, the analysis in this report shows that the framework surrounding Stibor is associated with a number of deficiencies that risk affecting confidence in the benchmark rate. There is thus scope to implement reforms to enhance confidence in Stibor. This section proposes some reforms that could contribute to remedying the problems identified. The proposed reforms are gathered into three main areas, reforming the *Institutional and organisational structure, Market and incentive structure* and *Public oversight and supervision*. Although it is not possible to rule out marginal effects from the proposed reforms on the pricing of financial contracts that refer to Stibor, the assessment is that the long-run positive effect on confidence outweighs this. It is important to point out that the proposals for reforming Stibor are based on the deficiencies identified in this report. Overseeing and evaluating Stibor is an on-going process that means that other deficiencies may be identified and that the proposed reforms may prove to be insufficient to manage the deficiencies that have already been identified.

5.1 Institutional and organisational structure

RESPONSIBILITY FOR STIBOR

An individual agent with a clear responsibility for Stibor is needed. This would create the right conditions for establishing a uniform framework of agreements and rules on Stibor for the banks determining Stibor to follow. It would also be possible to hold the individual agent accountable for the way that the framework for Stibor functions.

At present it is common that the banking associations in various countries are responsible for the benchmark rate. This is the case, for instance, with the British Libor benchmark rate (see Chapter 2). However, in the case of Libor it is being proposed that responsibility be transferred from the bankers association to a new, independent agent (see the box Benchmark rates are examined internationally). Of course, this does not rule out the possibility of bankers' associations in other countries having this responsibility. On the contrary, one can say that, in Sweden, the Swedish Bankers' Association has currently the right conditions for taking responsibility for Stibor, as all of the banks in the Stibor panel are represented in this organisation at the managing director level. In addition, the Swedish Bankers' Association has a broad selection of members, who would thus be given an

opportunity to influence the shaping of the framework for Stibor. However, in the long run it is not self-evident which agent should have the overall responsibility for Stibor. Regardless of who takes responsibility, this will need to be regularly assessed.

GOVERNANCE AND CONTROL

A uniform framework of agreements and rules for the banks that determine Stibor to follow is needed. It is also important to establish a clear structure to follow up the observance of this framework. In addition, an organisation that can deal with questions or complaints regarding Stibor from the general public and other interested parties is needed. All of this is important to maintain long-term confidence in the benchmark rate on the financial markets and among the general public.

There is also a need for a code of conduct for the banks determining Stibor. This is in line with one of the proposed reforms for the British benchmark rate, Libor (see the box Benchmark rates are examined internationally). Such a code of conduct could include rules for the banks' internal organisation and work on Stibor. The rules should be aimed, for instance, at reducing the incentives for manipulation or other unlawful behaviour when setting the benchmark rate. The rules would therefore need to be designed to counteract possible internal conflicts of interest within the banks participating in the Stibor panel.

To attain full transparency and the possibility of monitoring and supervision, Finansinspektionen and the Riksbank should have full insight into all discussions and matters concerning Stibor. Such insight would facilitate independent scrutiny of the pricing of the benchmark rate to identify potential systematic patterns or distortions in this.

TRANSPARENCY

To strengthen confidence in Stibor it is important that the framework around Stibor is open and accessible to the general public. This is to create an opportunity for the general public and other interested parties to understand and evaluate the benchmark rate.

As shown in Chapter 2, there is currently no clearly-worded definition of Stibor. It is therefore necessary to draw up a definition that does not leave scope for different interpretations. A clear definition is essential to create understanding of and confidence in the benchmark rate among the general public, and it should also enable the benchmark rate to be determined in an efficient manner.

5.2 Market and incentives structure

POSSIBILITY TO VERIFY STIBOR

To create better opportunities to verify Stibor on the basis of market pricing, it would be best to include a condition in the Stibor agreement stating that the banks in the panel should regularly issue and quote interest rates for bank certificates in Swedish krona for maturities for which Stibor is determined. A minimum requirement is however that the banks submit bid rates for their own bank certificates in Swedish krona. This would create a practicable benchmark when deriving Stibor and would be a further source of information when determining Stibor, which would contribute to the reliability of the benchmark rate. These interest rates should also be made available to the public to create a higher degree of transparency around the pricing of Stibor.

In addition, the banks in the Stibor panel should register on a daily basis all of the variables on which their Stibor submissions are based. This information should continuously be made available to Finansinspektionen and the Riksbank so that they can exercise supervision and oversee how the benchmark rate is determined. The Stibor banks say that they primarily use foreign exchange swaps in USD/SEK and EUR/SEK, but also interest rates for actual unsecured interbank loans in Swedish krona, as a basis for determining Stibor (see Chapter 2). To enable adequate verifiability and assessment of Stibor, the banks thus need to register the variables that are used as a basis, as well as possible further variables that they choose to include when making their Stibor submissions. This includes, for instance, the interest rate for the respective currency, forward rates and spot rates for the various currency pairs.

Moreover, it should be practice among the banks to register and store all information on potential trading at submissions in the submission process. This information would need to include data on the exact time of the transaction, the nominal amount, the interest rate and whether the transaction was a loan or a deposit. This data could contribute a lot to the authorities' day-to-day supervision and oversight as it could give indications of whether the incentives in the submission process were correct. This information, like other information, would therefore need to be made available to Finansinspektionen and the Riksbank.

NUMBER OF BANKS ON THE STIBOR PANEL

One aim of the framework for Stibor should be to reduce the incentive for the banks to collaborate when determining Stibor. It is therefore important that the Stibor panel includes all banks that are suitable as participants and that are able and interested in participating. This should reasonably include banks that use

financial contracts tied to Stibor and which have lending and funding in Swedish krona that requires extensive liquidity management in the currency.

It is therefore important that the Stibor framework is designed so that it does not exclude banks that could take part in the panel. One condition for this is that it is not only the current Stibor banks which determine which banks should participate and which should not. It is therefore appropriate to transfer responsibility for Stibor to an agent that is governed by a broader circle of Swedish banks. A further condition is that the trading units covered by the Stibor submissions, and the number of maturities for which Stibor is determined are calibrated so that smaller banks are not excluded because of the potential risk exposures entailed in the submission process (see below).

INCENTIVES IN THE SUBMISSION PROCESS WHEN STIBOR IS DETERMINED

The banks need to be bound by the submissions they make, by being obliged to lend or accept deposits at their submissions if so requested. The framework would then give the banks strong incentives to make submissions that they are prepared to offer for loans in accordance with the definition of Stibor. They then have an incentive to maintain a high level of precision when determining Stibor. Moreover, to attain this, the openness of the submission process needs to be limited so that the banks cannot see one another's submissions during the first stage of the submission process. This, together with introducing commitments for the banks by their submissions, would mean that they did not have the possibility to make similar submissions to avoid loans and deposits.

However, it is important that the banks' reported individual submissions continue to be published without delay as soon as the average benchmark rates have been calculated. This is a basic requirement for transparency that is a necessary condition for upholding and maintaining confidence in benchmark rates. It should also be shown whether or not the submissions are converted into actual contracts.

THE SIZE OF THE TRADING UNITS AND THE NUMBER OF MATURITIES

The obligation to provide loans and accept deposits on request (see *Incentives in the submission process when determining Stibor*) would aim to give the banks the incentive to make correct submissions that they are actually prepared to offer for loans according to the definition of Stibor. It should therefore neither provide a source of regular funding for the banks in the Stibor panel nor be an unreasonable burden on the banks' balance sheets. It should also be compatible with the applicable regulations on capital adequacy and liquidity risk, as well as with the banks' internal counterparty limits. It is therefore important that the size

of the trading units for which the Stibor submissions will apply is adapted so that the incentives to state correct submissions are reinforced at the same time as the trading opportunities are not used for funding. However, this must be balanced against the trading units not being so small that they are entirely without effect. The trading units must therefore be so large that they have some effect on the banks' balance sheets, as otherwise there is a risk that they will be indifferent to the trading.

With regard to the number of maturities, the banks' use of Stibor in financial contracts can provide guidance (see Table 1). Stibor is only used to a very limited extent for the maturities 2 months, 9 months and 12 months. The appropriateness of determining Stibor for these maturities can thus be questioned. The Wheatley Review also proposes that the number of maturities for which Libor is determined should be reduced and that the maturities that are not used in practice should be withdrawn. It is also important that the maturities and trading units, as well as the framework in general, do not exclude smaller banks.

5.3 Public monitoring and supervision

FUTURE ROLES OF THE RIKSBANK AND FINANSINSPEKTIONEN

According to what has been stated earlier, Stibor has a major impact on the Swedish credit market. It is important to the efficiency of the market, that the general public has confidence in the interest rate being set in accordance with the valid regulations and in a verifiable manner.

The Riksbank will continue to take a more active role in the ongoing supervision and analysis of the pricing of Stibor. This monitoring work is aimed at examining the pricing of the benchmark rate and identifying potential systemic patterns or distortions in the rate. Among other steps, the Riksbank intends to make a new assessment of Stibor in 2014 in order to follow up the reform work and the functioning of the framework surrounding Stibor. These activities are in line with the Riksbank's tasks regarding financial stability and monetary policy. As Stibor is used as a base for many financial contracts, it is an important element in the monetary policy transmission mechanism from the repo rate to the interest rates paid by households and companies. At the same time, confidence in Stibor is important for the stability of the financial system. The Riksbank's analysis will also be made available to the general public, so that it can contribute to the transparency around Stibor.

Finansinspektionen already has the possibility to conduct supervision over individual Stibor banks, and can at any time make an investigation in which the banks are asked to provide information regarding their participation in the Stibor panel. As shown in the box International work on benchmark rates, there is also

work within the EU that aims, for instance, to ensure that the relevant regulations and directives also cover the manipulation of benchmark rates. This could affect Finansinspektionen's work in the future. Finansinspektionen will continue to exercise supervision over the banks that determine Stibor, so that they follow the regulations regarding for example conflicts of interest and market abuse. To identify potential manipulation or other unacceptable behaviour in connection with setting rates, Finansinspektionen needs to regularly monitor Stibor as part of its supervision work.

There may also be reason to consider whether benchmark rates of a certain scope should be subjected to regulation under commercial law, in addition to the European Commission's work mentioned above. Such regulation need not necessarily cover the methods for determining the benchmark rate. It is more a question of setting certain minimum requirements regarding responsibility, transparency and supervision by public authorities.

Benchmark rates examined internationally

Since 2009, supervisory authorities in several countries such as the United Kingdom, the United States, Canada and Japan, as well as the EU, have examined the Libor, Euribor and Tibor benchmark rates. In connection with the announcement that the major British bank Barclays had manipulated Libor, the British government gave Martin Wheatley, the designated Managing Director of the Financial Conduct Authority (FCA), the task of heading a review of Libor. This review was concluded in September 2012 with the presentation of a final report containing proposals for reforming Libor. Several other international organisations have initiated work on examining globally-important benchmark rates and indices. The work is aimed at producing guidelines and principles for how benchmark rates and indices should be determined, examined and supervised, as well as coordinating the work conducted in this field in different countries. This article provides an outline of the work being done.

THE REVIEW OF LIBOR

Wheatley's final report and findings resulted in three fundamental conclusions:

- A comprehensive reform of Libor is preferable to replacing it.
- Transaction data should be explicitly used to support Libor submissions.
- Market participants should continue to play a significant role in the process of determining Libor and in the oversight of the benchmark rate.

Based on these conclusions, Wheatley presented a 10-point plan for reforming Libor. The proposals were presented to the British government in October 2012, and received its full support. They are now to be included in the bill on reformed legislation for the financial sector to be put before parliament in December 2012. Below is a summary of the proposed reforms:

1. The new Financial Conduct Authority (FCA) should regulate administration of, and submission to, Libor. There should also be criminal law consequences for any attempt at manipulation.
2. The British Bankers' Association should transfer responsibility for Libor to a new administrator, chosen by an independent committee.
3. The new administrator should examine the banks' submitted Libor rates and regularly assess the

efficiency in the determination of the rate.

4. A new code of conduct should be introduced for the banks determining Libor and should be approved by the FCA.
5. Libor should as far as possible be based on, and supported by, transaction data.
6. To improve the capacity to support submitted rates with transaction data, the number of currencies and maturities for which Libor is determined should be reduced substantially to attain a greater focus on the rates that are used the most.
7. The banks' individual submitted rates for determining Libor should be published with a three-month delay to reduce the incentives for the banks to try to embellish the image of their creditworthiness and to reduce the capacity for cooperation between the banks on the Libor panel.
8. The government should give the Financial Conduct Authority new powers of regulatory compulsion to encourage banks to participate as widely as possible in the Libor compilation process.
9. All market participants using Libor should be encouraged to consider and evaluate their use of Libor, including a consideration of whether Libor is the most appropriate benchmark for the transactions they undertake and whether their standard contracts contain adequate contingency provisions covering the event of Libor not being produced.
10. The UK authorities should work closely with the European and international community on establishing and promoting clear principles for effective global benchmarks.

INTERNATIONAL ORGANIZATION OF SECURITIES COMMISSION (IOSCO)

In September 2012, the IOSCO formed a task force charged with reviewing issues related to the benchmark rates and indices that are used in pricing contracts in the financial sector and on the commodities markets. The task force is charged with setting out global guidelines and principles for benchmark rates and indices. It is to produce a consultation paper at the end of 2012 and then complete a final report at the end of the first quarter of 2013.

The IOSCO is to set out global guidelines and principles for benchmark rates and indices that will be completed at the end of the first quarter of 2013.

EUROPEAN COMMISSION

In 2000, the EU Market Abuse Regulation was introduced, which criminalises the manipulation of pricing of financial instruments. This regulation is directly applicable to Swedish financial institutions. At present, however, the regulation is not explicit with regard to the manipulation of benchmark rates or indices. Although it can indirectly include such manipulation, the lack of an explicit formulation may make it difficult for authorities to prove that it has occurred.

This has caused the European Commission to propose an addition to the regulation, which entails attempts to and manipulation of benchmark rates and indices also being considered to be market abuse. The European Commission has also proposed an addition to the Market Abuse Regulation and Market Abuse Directive that specifies what is referred to by gross manipulation of benchmark rates and other indices. The proposals were made in September and since then there have been negotiations between the EU countries prior to a future decision in the European Parliament and European Council on the new regulation.

In September, the European Commission also published a consultation aimed at authorities and market participants containing questions on benchmark rates and how to safeguard the integrity of the financial markets. This consultation was aimed to provide the European Commission with guidance in its future work on legislation in this area.

FINANCIAL STABILITY BOARD (FSB)

The FSB has taken the initiative in coordinating the current work at national level on reviewing benchmark rates. This coordination work mainly concerns communicating information and results from national reviews of benchmark rates, authorities on other important markets contributing to the work on national reviews of globally-important benchmark rates and ensuring that the design of the recommendations in which the national reviews of benchmark rates result is coordinated.

Appendix 1. Statistics and figures

Descriptive statistics

Table A1. Descriptive statistics on turnover in unsecured interbank loans

	STIBOR BANKS' LOANS FROM ONE ANOTHER	STIBOR BANKS' LOANS FROM THE LARGER SAMPLE OF BANKS
Mean value	2 536 136 560	683 225 322
Standard error	24 811 653	6 689 935
Median	1 841 200 000	142 632 000
Typical value	2 000 000 000	2 000 000 000
Standard deviation	3 091 416 431	4 583 367 502
Kurtosis	17	108 906
Skewness	3	293
Number of observations	15 524	469 381

Source: The Riksbank

Table A2. Descriptive statistics on interest rates for unsecured interbank loans

	STIBOR BANKS' LOANS FROM ONE ANOTHER	STIBOR BANKS' LOANS FROM THE LARGER SAMPLE OF BANKS
Mean value	2.3	2.3
Standard error	0.0	0.0
Median	2.0	2.0
Typical value	4.3	0.1
Standard deviation	1.9	1.9
Kurtosis	5.2	1.6
Skewness	1.2	0.7
Number of observations	15 524	469 381

Source: The Riksbank

Table A3. Descriptive statistics on turnover volumes for foreign exchange swap transactions

Mean value	234 484 914
Standard error	1 080 966
Median	10 006 234
Typical value	5 000 000
Standard deviation	724 877 690
Kurtosis	155
Skewness	8
Number of observations	449 682

Source: The Riksbank

Table A4. Descriptive statistics on the Stibor banks' submissions

Mean value	3.1
Standard error	0.0
Median	3.1
Typical value	2.1
Standard deviation	1.6
Kurtosis	14 852
Skewness	65.5
Number of observations	185 386

Source: The Riksbank

Table A5. Percentage of days when unsecured loans in Swedish krona between the Stibor banks have taken place, entire period 2007-2011
Number of days as a percentage of total number of days

	O/N	T/N	S/N	1W	2W	1M	2M	3M	4M	5M	6M	7M	8M	9M	10M	11M	12M
No loans	18	42	98	99	99	100	100	100	100	100	100	100	100	100	100	100	100
At least 1 loan	82	58	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0
More than 1 loan	65	33	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
More than 2 loans	52	16	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
More than 5 loans	10	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Source: The Riksbank

Table A6. Percentage of days when unsecured loans in Swedish krona between the Stibor banks have taken place, period prior to crisis, 2007 to end of August 2008
Number of days as a percentage of total number of days

	O/N	T/N	S/N	1W	2W	1M	2M	3M	4M	5M	6M	7M	8M	9M	10M	11M	12M
No loans	2	44	98	99	99	100	100	100	100	100	100	100	100	100	100	100	100
At least 1 loan	98	56	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0
More than 1 loan	96	32	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
More than 2 loans	90	15	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
More than 5 loans	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note. The data for the table consists of transaction data from the period January 2007 to the end of August 2008 when there was no acute financial crisis and the Riksbank was not offering extensive extraordinary loans.
Source: The Riksbank

Table A7. Percentage of days when unsecured loans in Swedish krona between the Stibor banks have taken place, period after the crisis, November 2010 to end of 2011
Number of days as a percentage of total number of days

	O/N	T/N	S/N	1W	2W	1M	2M	3M	4M	5M	6M	7M	8M	9M	10M	11M	12M
No loans	3	25	97	100	100	100	100	100	100	100	100	100	100	100	100	100	100
At least 1 loan	97	75	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
More than 1 loan	88	50	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
More than 2 loans	63	23	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
More than 5 loans	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note. The data for the table consists of transaction data from the period November 2010 to the end of December 2011 when there was no acute financial crisis and the Riksbank was not offering extensive extraordinary loans.
Source: The Riksbank

Table A8. Percentage of days when unsecured loans in Swedish krona to the Stibor banks from the larger sample of banks have taken place, entire period 2007-2011
Number of days as a percentage of total number of days

	O/N	T/N	S/N	1W	2W	1M	2M	3M	4M	5M	6M	7M	8M	9M	10M	11M	12M
No loans	1	0	35	9	49	52	94	87	98	100	95	100	100	100	100	100	97
At least 1 loan	99	100	65	91	51	48	6	13	2	0	5	0	0	0	0	0	3
More than 1 loan	99	100	33	73	21	15	0	3	0	0	0	0	0	0	0	0	0
More than 2 loans	99	100	15	53	8	5	0	0	0	0	0	0	0	0	0	0	0
More than 5 loans	99	99	4	10	0	0	0	0	0	0	0	0	0	0	0	0	0
More than 10 loans	99	97	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Source: The Riksbank

Table A9. Percentage of days when unsecured loans in Swedish krona to the Stibor banks from the larger sample of banks have taken place, period prior to the crisis, 2007 until the end of August 2008
Number of days as a percentage of total number of days

	O/N	T/N	S/N	1W	2W	1M	2M	3M	4M	5M	6M	7M	8M	9M	10M	11M	12M
No loans	1	0	33	5	54	54	94	90	100	100	96	100	100	100	100	100	96
At least 1 loan	99	100	67	95	46	46	6	10	0	0	4	0	0	0	0	0	4
More than 1 loans	99	100	36	81	17	14	0	1	0	0	0	0	0	0	0	0	0
More than 2 loans	99	100	19	62	6	5	0	0	0	0	0	0	0	0	0	0	0
More than 5 loans	99	99	6	15	0	0	0	0	0	0	0	0	0	0	0	0	0
More than 10 loans	99	98	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note. The data for the table consists of transaction data from the period January 2007 to the end of August 2008 when there was no acute financial crisis and the Riksbank was not offering extensive extraordinary loans.
Source: The Riksbank

Table A10. Percentage of days when unsecured loans in Swedish krona to the Stibor banks from the larger sample of banks have taken place, period prior to the crisis, November 2010 until the end of August 2011
Number of days as a percentage of total number of days

	O/N	T/N	S/N	1W	2W	1M	2M	3M	4M	5M	6M	7M	8M	9M	10M	11M	12M
No loans	1	1	40	10	51	70	95	84	99	100	99	100	100	100	100	100	100
At least 1 loan	99	99	60	90	49	30	5	16	1	0	1	0	0	0	0	0	0
More than 1 loans	99	99	27	68	18	5	0	4	0	0	0	0	0	0	0	0	0
More than 2 loans	99	99	10	41	5	0	0	1	0	0	0	0	0	0	0	0	0
More than 5 loans	99	99	3	5	0	0	0	0	0	0	0	0	0	0	0	0	0
More than 10 loans	99	92	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note. The data for the table consists of transaction data from the period November 2010 to the end of December 2011 when there was no acute financial crisis and the Riksbank was not offering extensive extraordinary loans.
Source: The Riksbank

Table A11. Percentage of days when foreign exchange swap transactions made by the Stibor banks have taken place, entire period 2007-2011
Number of days as a percentage of total number of days

	O/N	T/N	S/N	1W	2W	1M	2M	3M	4M	5M	6M	7M	8M	9M	10M	11M	12M
No transactions	1	2	1	1	0	0	0	0	5	11	6	26	34	29	38	42	37
At least 1 transaction	99	98	99	99	100	100	100	100	95	89	94	74	66	71	62	58	63
More than 1 transaction	99	98	97	99	100	100	100	99	84	71	81	47	37	41	33	32	38
More than 2 transactions	99	97	96	99	99	100	98	97	68	52	66	26	20	24	16	16	23
More than 5 transactions	97	95	86	96	93	100	91	87	29	16	26	4	3	4	2	1	4
More than 10 transactions	95	81	58	86	71	99	62	49	4	2	4	1	0	0	0	0	0

Note. The table refers to foreign exchange swap transactions where Swedish krona is one of the currencies.
Source: The Riksbank

Table A12. Number of days when foreign exchange swap transactions made by the Stibor banks have taken place, period prior to the crisis, 2007 to the end of August 2008
Number of days as a percentage of total number of days

	O/N	T/N	S/N	1W	2W	1M	2M	3M	4M	5M	6M	7M	8M	9M	10M	11M	12M
No transactions	1	3	1	1	0	0	0	1	6	15	7	32	37	33	42	45	44
At least 1 transaction	99	97	99	99	100	100	100	99	94	85	93	68	63	67	58	55	56
More than 1 transaction	99	96	97	99	100	100	99	98	79	64	75	40	34	36	31	30	31
More than 2 transactions	99	96	96	99	99	100	96	96	62	47	58	22	20	20	14	15	15
More than 5 transactions	96	96	91	94	89	100	82	79	22	10	22	2	3	4	1	1	2
More than 10 transactions	93	92	69	76	57	98	41	31	3	1	3	0	0	0	0	0	0

Note. The data for the table consists of transaction data from the period January 2007 to the end of August 2008 when there was no acute financial crisis and the Riksbank was not offering extensive extraordinary loans. The table refers to foreign exchange swap transactions where Swedish krona is one of the currencies.
Source: The Riksbank

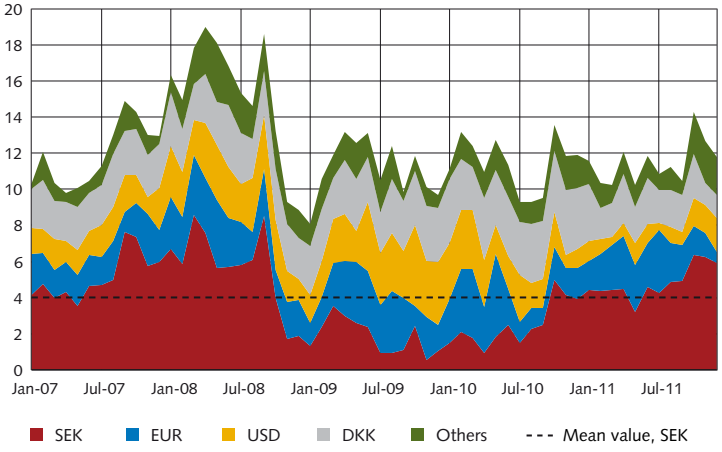
Table A13. Percentage of days when foreign exchange swap transactions made by the Stibor banks have taken place, period after the crisis, November 2010 to the end of 2011
Number of days as a percentage of total number of days

	O/N	T/N	S/N	1W	2W	1M	2M	3M	4M	5M	6M	7M	8M	9M	10M	11M	12M
No transactions	1	1	1	0	0	0	0	0	3	6	4	23	31	26	36	41	41
At least 1 transaction	99	99	99	100	100	100	100	100	97	94	96	77	69	74	64	59	59
More than 1 transaction	99	98	97	100	100	100	100	100	90	77	86	52	38	46	33	30	30
More than 2 transactions	99	98	96	100	99	100	100	99	77	58	74	33	22	27	17	16	20
More than 5 transactions	99	96	81	99	97	100	99	95	39	23	35	10	3	5	2	1	3
More than 10 transactions	96	89	46	93	76	99	85	66	6	3	7	2	0	1	0	0	0

Note. The data for the table consists of transaction data from the period November 2010 to the end of December 2011 when there was no acute financial crisis and the Riksbank was not offering extensive extraordinary loans. The table refers to foreign exchange swap transactions where Swedish krona is one of the currencies.
Source: The Riksbank

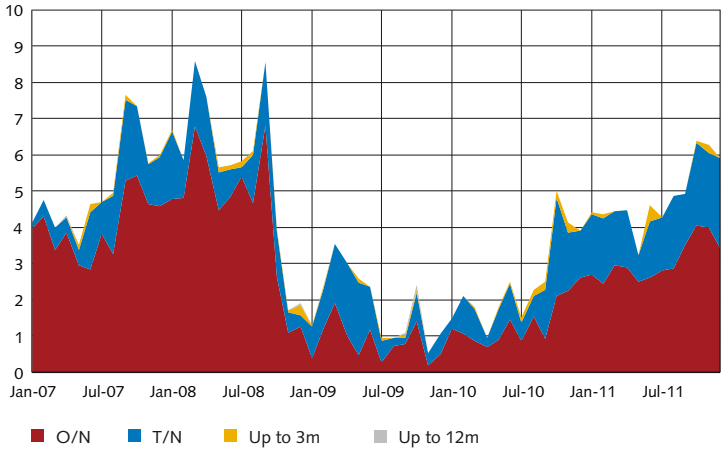
Charts showing turnover volumes on the interbank market

Chart A1. Currency breakdown in the Stibor banks' unsecured loans from one another
Number of loans



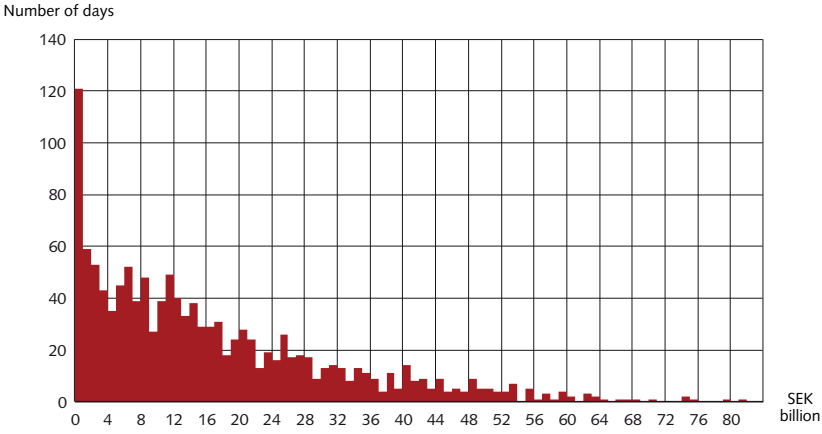
Note. The chart shows the average daily number of loans per month.
Source: The Riksbank

Chart A2. Maturities breakdown in the Stibor banks' unsecured loans in Swedish krona from one another
Number of loans



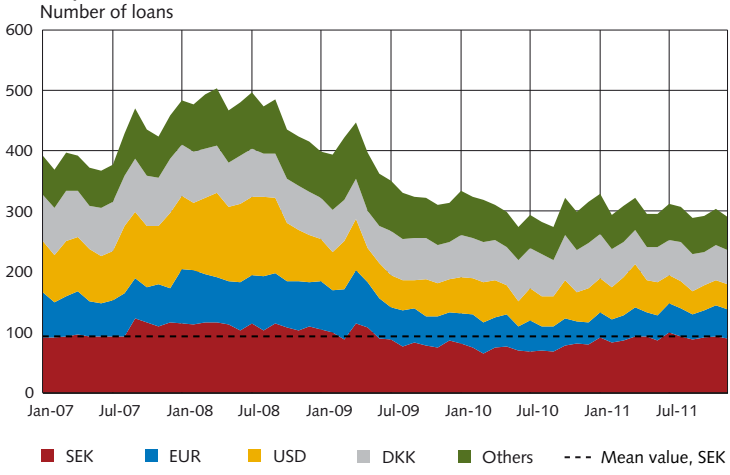
Note. The chart shows the average daily number of loans per month.
Source: The Riksbank

Chart A3. Breakdown of daily average turnover volume in unsecured loans in Swedish krona between the Stibor banks



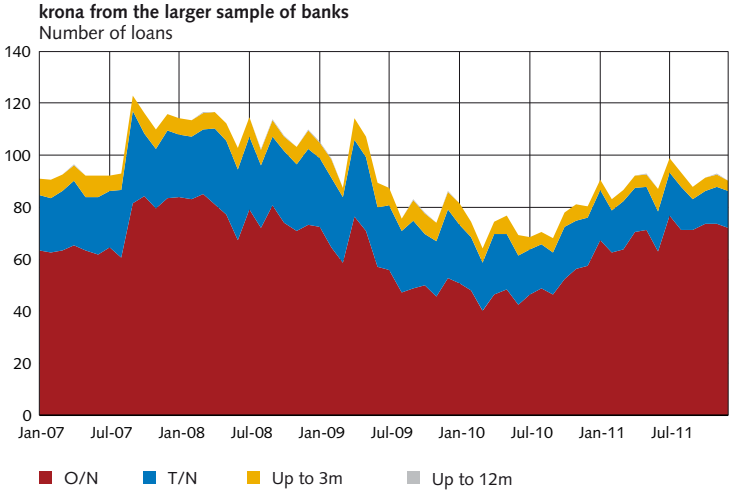
Source: The Riksbank

Chart A4. Currency breakdown in the Stibor banks' unsecured loans from the larger sample of banks



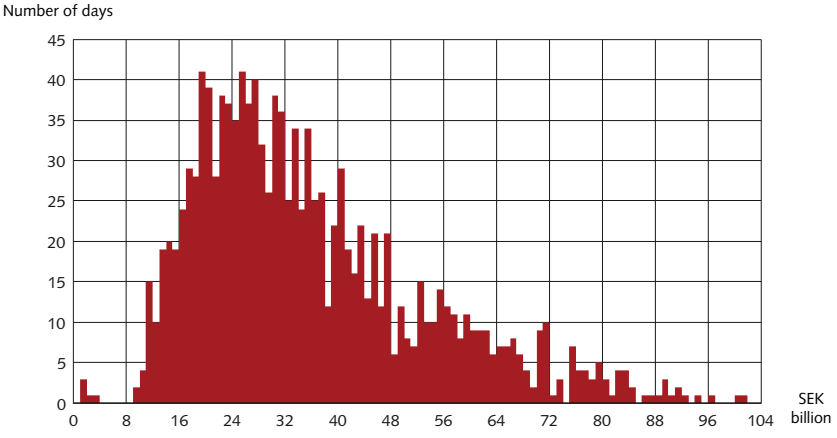
Note. The chart shows the average daily number of loans per month.
Source: The Riksbank

Chart A5. Maturities breakdown in the Stibor banks' unsecured loans in Swedish krona from the larger sample of banks



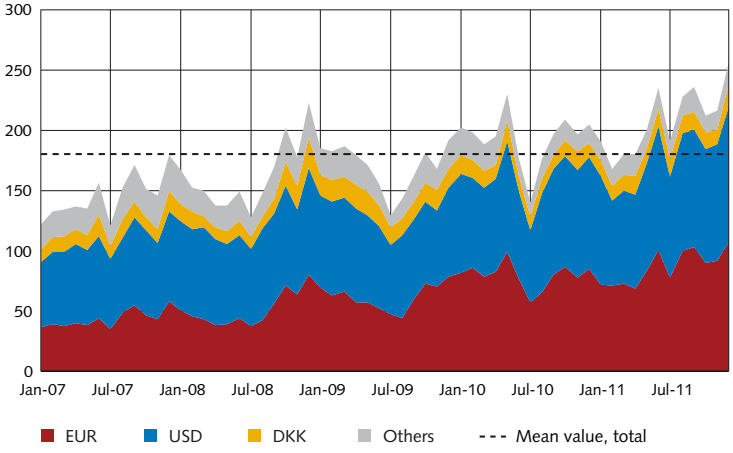
Note. The chart shows the average daily number of loans per month.
Source: The Riksbank

Chart A6. Breakdown of daily turnover volume in unsecured loans in Swedish krona to the Stibor banks from the larger sample of banks



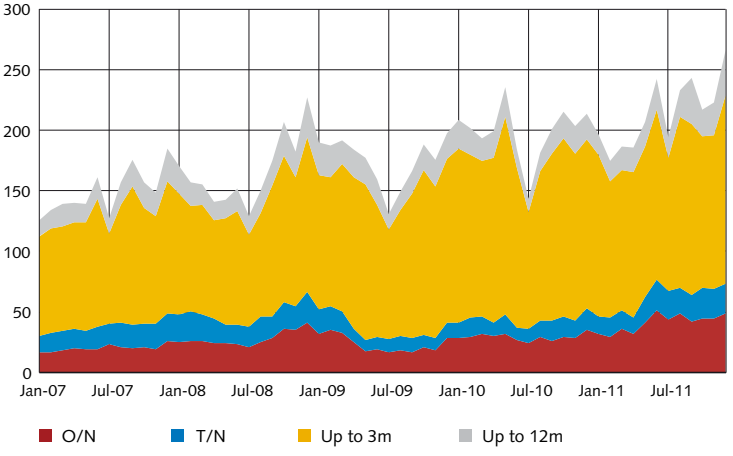
Source: The Riksbank

Chart A7. Currency breakdown in the Stibor banks' foreign exchange swap transactions
Number of transactions



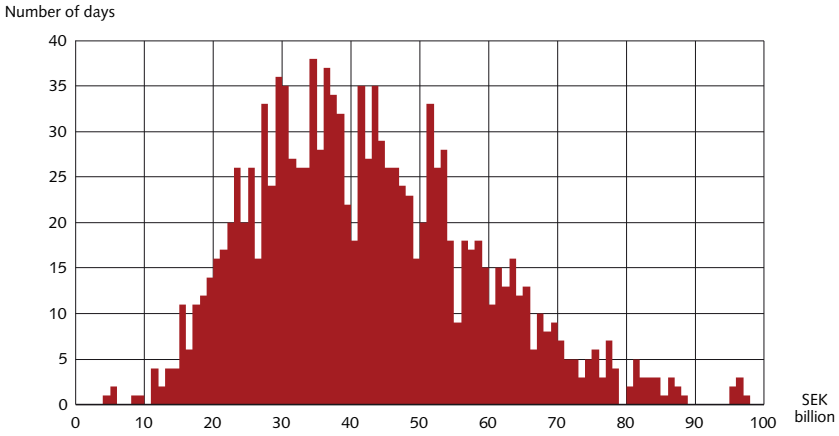
Note. The chart shows the average daily number of transactions per month.
Source: The Riksbank

Chart A8. Maturities breakdown in the Stibor banks' foreign exchange swap transactions
Number of transactions



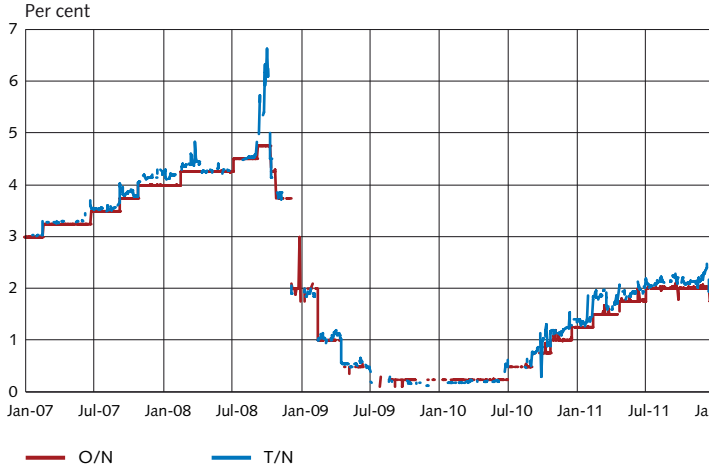
Note. The chart shows the average daily number of transactions per month.
Source: The Riksbank

Chart A9. Breakdown of daily turnover volume of the Stibor banks' foreign exchange swap transactions



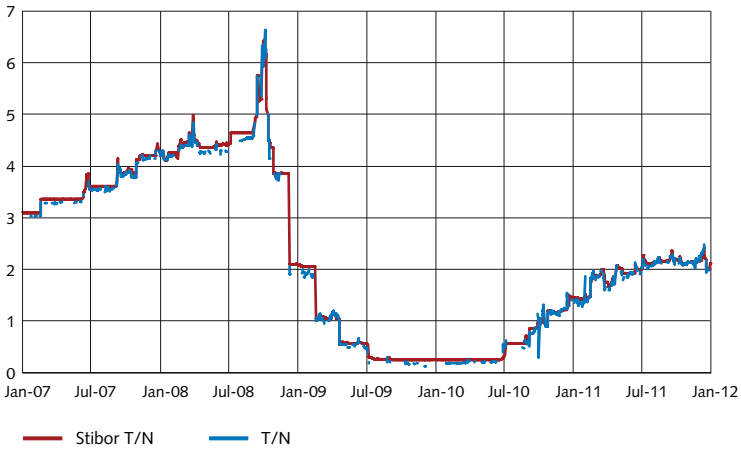
Source: The Riksbank

Chart A10. Volume-weighted interest rates for loans in Swedish krona between the Stibor banks with maturities O/N and T/N



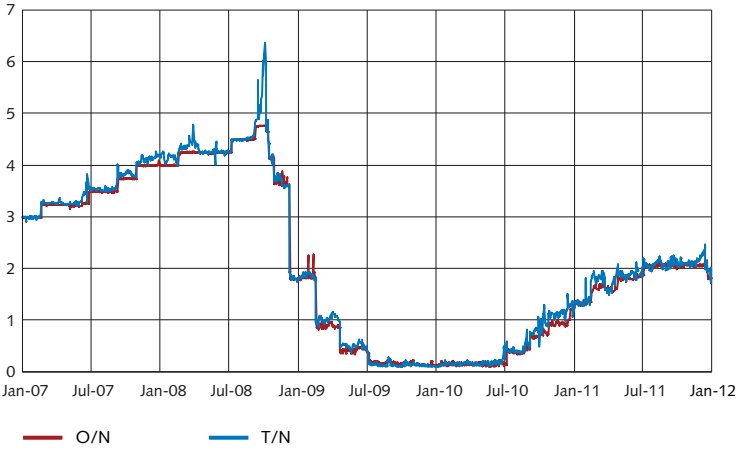
Note. The interest rates have been calculated as a weighted average of the daily transaction
Each interest rate has been multiplied by a weight based on the transaction volume as a per
of the total turnover volume during the day.
Source: The Riksbank

Chart A11. Stibor and volume-weighted interest rates for loans in Swedish krona between the Stibor banks, maturity T/N
Per cent



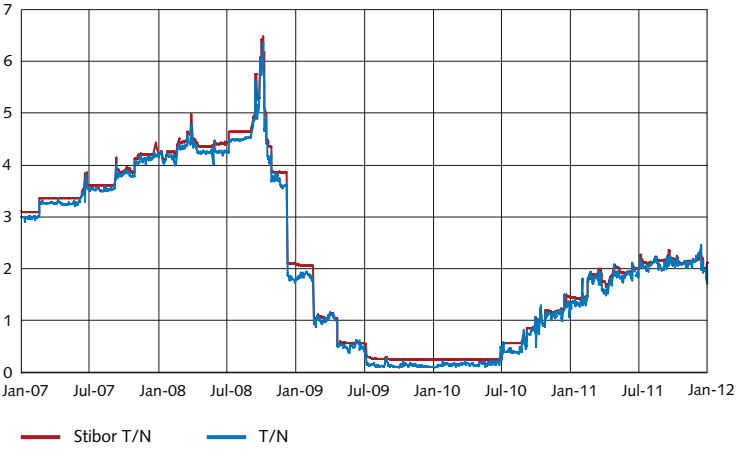
Note. The interest rates have been calculated as a weighted average of the daily transactions. Each interest rate has been multiplied by a weight based on the transaction volume as a percentage of the total turnover volume during the day.
Source: The Riksbank

Chart A12. Volume-weighted interest rates for unsecured loans in Swedish krona to the Stibor banks with maturities O/N and T/N from the larger sample of banks
Per cent



Note. The interest rates have been calculated as a weighted average of the daily transactions. Each interest rate has been multiplied by a weight based on the transaction volume as a percentage of the total turnover volume during the day.
Source: The Riksbank

Chart A13. Stibor and volume-weighted interest rates for interbank loans in Swedish krona to the Stibor banks from the larger sample of banks, maturity T/N
Per cent



Note. The interest rates have been calculated as a weighted average of the daily transactions. Each interest rate has been multiplied by a weight based on the transaction volume as a percentage of the total turnover volume during the day.
Source: The Riksbank

Appendix 2. Glossary

Arbitrage: Buying or selling incorrectly-priced assets to generate return without taking market risk.

Arithmetic mean value: The sum of all values divided by the number of values (also known as simple average).

BBA, British Bankers' Association: The United Kingdom's bankers' association.

Bank certificate: A certificate issued by a bank, made out to the holder and with a maturity of no more than one year.

Balancing liquidity: The financial operations of market participants generate payment flows but, as it is not possible to predict all payment undertakings, pay-ins and pay-outs do not always entirely match timewise. The market participants make liquidity forecasts to plan their payment flows as well in advance as possible in order to minimise daily imbalances in their current accounts. Daily deficits and surpluses resulting from differences between inflows and outflows are balanced using various financial contracts at short maturities.

Bond: A debt instrument in the form of an agreement to lend money that is subsequently repaid with interest.

Certificate: A debt instrument of the same type as a treasury bill but the issuer is, for example, a bank or a non-financial company.

Cibor, Copenhagen Interbank Offered Rate: The benchmark rate on the interbank market for Danish krona.

Counterparty: The other party in a financial transaction (for example every party that conducts transactions with a central bank).

Counterparty risk: Counterparty risk refers to the risk that the counterparty in a transaction cannot meet its commitments to pay for or deliver an agreed financial contract.

Credit risk: The risk of a borrower failing to meet commitments.

Debt security: A security that gives the buyer the right to a fixed rate of return in the form of an interest rate.

Derivative instrument: Financial instrument that entails agreements on commitments or rights at a given future point in time. The value of a derivative instrument is linked to an underlying asset. The most common derivative instruments are options, futures and swaps.

EBA, The European Banking Authority: Establishes joint standards for bank regulation and supervision within the EU and carries out stress tests on European banks.

ESMA, European Securities and Markets Authority: The European authority for securities and markets.

Euribor, Euro Interbank Offered Rate: The benchmark rate on the interbank market for euro.

Foreign exchange: A derivative instrument (see "Derivative instrument" above) whose value is determined by the development of foreign exchange rates.

Foreign exchange derivative: Loans raised abroad can be converted to Swedish krona through the use of currency derivatives.

Forward: A transaction with a financial contract in which payment and delivery, in contrast to a spot transaction, do not take place immediately but at a point further in the future, for example in three months' time. A forward contract obliges the buyer and seller to carry out the future transaction at the predetermined forward rate.

FSB, Financial Stability Board: Coordinates the work of national authorities and international regulatory bodies in the field of financial stability. Also identifies vulnerabilities and develops, coordinates and implements international regulations and supervision.

Government security: A fixed-interest security issued by the government.

Interbank market: The banks' internal market for loans, currencies, debt securities and other financial contracts.

Interbank rate: Interest rates for unsecured loans that banks offer to one another.

Interest rate derivative: A derivative instrument (see "Derivative instrument" above) whose value is determined by the development of interest rates.

Interest rate parity:A theoretical relation that says that the ratio between forward and spot rates for two currencies should be equal to the ratio between the interest rates for lending and investing in the two currencies.

IOSCO, International Organisation of Securities Commission: Over 100 supervisory authorities cooperate in IOSCO on common regulations for security-market participants. An important part of IOSCO's work is to exchange information on events on the security markets and in the financial companies. IOSCO adopts recommendations to its members on how they should deal with various supervisory issues.

Kurtosis: A statistical measure that describes the concentration of observations around their mean value. In other words, kurtosis describes how "peaked" the distribution around the mean value is.

Libor, London Interbank Offered Rate: The benchmark rate on the interbank markets for a number of different currencies, including American dollars and British pounds.

Liquidity: Measure of the ability of a company or organisation to meet its payment obligations in the short term. Can also describe how quickly it is possible to convert an asset into money.

Liquidity premium: The price that reflects how the market values the cost of divesting cash. This price may depend on how easily a security can be sold on the market or how easy it is to borrow on the market.

Market-maker: Those who have undertaken to continually list bid and ask prices for one or several types of financial contract and thus enable trading on a market.

MFI, Monetary Financial Institution: A generic term for banks, mortgage institutions, financial companies, municipal and corporate-financed institutions, monetary securities companies and monetary investment funds (money market funds).

Money market: The fixed income market is often divided into a bond market and a money market. Trading on the money market comprises, for example, treasury bills, certificates and repos, usually with maturities of up to one year.

Net position: An expression used to describe a risk exposure that arises as a result of a difference between risk exposures in assets and liabilities.

Nibor, Norwegian Interbank Offered Rate: The benchmark rate on the interbank market for Norweigan krona.

O/N, overnight: Maturity from today to the following bank business day.

Order depth: The volume of submitted bid and sell orders on a market.

Repo: A financial instrument resembling a short-term loan. The participant receiving the money (the seller) transfers the security to the purchaser. At the same time, the seller undertakes to repurchase the security from the purchaser, at a predetermined date, for a slightly larger sum of money. The difference between the sale and the repurchase sums is equivalent to the interest rate on a loan.

Risk management instrument: Another term for derivative.

Risk premium: The additional return an investor requires as compensation for an additional risk.

Security: An overall term for shares, bonds and other financial instruments that represent an economic value and that can be traded.

SELMA statistics: The Riksbank's system for online reporting of turnover statistics by counterparties for the money and bond markets and foreign exchange market. Only reporters have access to the system.

Skewness: A statistical measure of the symmetry around the mean value for a given distribution of observations. A distribution in which the mean value does not correspond to the median on either side is often referred to as "skewed".

S/N, spot next: Maturity from the day after tomorrow until the bank business day after that.

Spot: When assets are delivered and paid for immediately after a sale. This can in practice mean two banking days after the closure of the deal. A spot transaction is conducted at the so-called spot rate.

Spread: Usually the difference between two interest rates on a financial market. On the bond market the spread is measured in basis points.

Tick data: A term that describes statistical material in which the time interval between observations is very short, for example one second or one minute.

T/N Tomorrow next: Maturity from the next bank business day to the bank business day after that.

Treasury bill: A debt instrument issued by the Swedish National Debt Office. The maturity of these instruments is usually up to one year.

Unsecured bond: A bond whose holder does not have a special priority in the event of a bankruptcy. Unsecured bonds normally entail a higher credit risk than covered bonds, which means that the borrowing costs are higher.

Wholesale funding: When a country, bank or company funds its activities by issuing various types of securities. Long-term wholesale funding consists of covered and unsecured bonds, while short-term wholesale funding consists, for example, of certificates of deposit and interbank borrowing.

References

Abrantes-Metz, R., Kraten, M., Metz, A., och Seow, G., (2012), "Libor manipulation?", *Journal of banking and Finance,* 36.

Abrantes-Metz, R. and Evans, D., (2012), "Replacing the LIBOR with a Transparent and Reliable Index of Interbank Borrowing: Comments on the Wheatley Review of LIBOR Initial Discussion Paper", *Mimeo*, 6 September.

Bernhardsen, T., Kloster, A., och Syrstad, O., (2012) "Risk premiums in NIBOR and other countries' interbank lending rates", *Staff Memo,* Nr. 21, Norges bank.

British Bankers' Association, (2012), "Implementation of reforms to LIBOR as recommended in 'The Wheatley Review of LIBOR'", *A consultative paper from the BBA,* November.

Danmarks Nationalbank, (2012), "Redogörelse om Nationalbankens deltagelse i Cibor-fastsaettelsen, 20 August.

Erhvervs- og vaekstministeriet, (2012), "Redogörelse om CIBOR", september.

Gadanecz, B., (2004), "The syndicated loan market: structure, development and implications", *BIS Quarterly Review,* December.

Gyntelberg, J. och Wooldridge, P., (2008), "Interbank rate fixings during the recent turmoil", *BIS Quarterly Review,* March.

HM Treasury, (2012), "The Wheatley review of LIBOR: final report", September.

Juks, R., (2012), "Asset encumberance and its relevance for financial stability", *Penning och valutapolitik,* No 3, Sveriges Riksbank.

Mollenkamp, C., och Norman, L., (2008), "British bankers group steps up review of widely used Libor", *Wall Street Journal,* 17 April.

Mollenkamp, C., och Whitehouse, M., (2008), "Study casts doubt on key rate; WSJ analysis suggests banks may have reported flawed interest data for Libor", *Wall Street Journal,* 29 May.

Wooldridge, P., (2001), "The emergence of new benchmark yield curves", *BIS Quarterly Review",* December.

Sveriges Riksbank
SE-103 37 Stockholm

Tel +46 8 787 00 00
Fax + 46 8 21 05 31
registratorn@riksbank.se
www.riksbank.se