

DANMARKS NATIONALBANK

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Oversight of the financial infrastructure

- Overall, operational reliability of the core systems and instruments of the Danish payments infrastructure has been satisfactory, and generally there has been ample liquidity in the systems for the settlement of payments.
- Danmarks Nationalbank has requested analyses whether the systems subject to oversight comply with the CPMI-IOSCO guidance on cyber resilience for financial market infrastructures. Some systems have made more progress than others with this work, which is monitored by Danmarks Nationalbank on a continuous basis.
- Danmarks Nationalbank's oversight focuses on the management of risks arising from interdependencies between the payments infrastructure systems. Formalised collaboration is being established between the systems subject to oversight, and the work of the FSOR helps to strengthen operational resilience across the systems.

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TRANSACTIONS



The operational stability

has been
satisfactory

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Particular focus on

cyber resilience and interdependencies
in the payments infrastructure

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Interconnectedness and risks

Danmarks Nationalbank oversees¹ core systems and instruments in the Danish payments infrastructure. This oversight comprises:

- Kronos
- the Sumclearing, Intradagclearing and Straksclearing
- VP settlement
- Dankort, Betalingsservice and credit transfers
- International systems of relevance to Denmark.

The systems in the payments infrastructure are closely interconnected and thus interdependent. The systems subject to oversight and the interaction between them are described in Box 2.

Interconnectedness is a prerequisite for an efficient payments infrastructure, but also entails the risk that operational incidents in one system may affect settlement in other systems, or that external problems, for instance a cyberattack, spread between the systems.

In April 2016, Danmarks Nationalbank recommended that the systems subject to oversight should strengthen their collaboration on identifying and addressing risks related to interdependencies, and that it be considered to establish joint testing of crisis response plans across the systems.

Formalised collaboration is being established between Kronos, VP and the retail payment systems with a view to identifying and assessing risks related to interdependencies and ensuring that robust measures are in place for addressing and monitoring the risks identified.

In other respects, several initiatives have been taken under the auspices of the Financial Sector forum for Operational Resilience, FSOR, to address risks across the infrastructure systems and instruments. The FSOR's initiatives, described in Box 1, help to meet Danmarks Nationalbank's recommendation for stronger collaboration between the systems subject to oversight, including the recommendation of joint testing of crisis response plans.

Background

Danmarks Nationalbank oversees that payments and securities transactions in Denmark can be effected in a safe, stable and efficient manner. In this report, Danmarks Nationalbank presents the general conclusions from its oversight in 2016 of the core systems and instruments of the Danish payments infrastructure. The report is published yearly.

Financial Sector forum for Operational Resilience

Box 1

The Financial Sector forum for Operational Resilience, FSOR, was set up in 2016 aiming to increase operational resilience, including cyber resilience, in the Danish financial sector. In addition to payment and settlement systems, participants in the forum include the largest Danish banks and mortgage banks, financial industry associations, authorities and others. The FSOR has published its terms of reference ([link](#)), its annual report for 2016 ([link](#)) and a vision describing areas of action and initiatives for the FSOR towards 2020 ([link](#)).

Testing of crisis response plans

In 2016, the FSOR established the financial sector crisis response plans to ensure cross-sector coordination in the event of serious operational incidents. The crisis response plans expand the existing emergency communication system.

The new crisis response plans were tested in November 2016. The scenario for the test was multiple cyberattacks against key elements of the financial infrastructure. The test is described in more detail in an FSOR publication ([link](#)). Under the auspices of the FSOR, work is now ongoing to translate the experience gained from the test into improved crisis response procedures.

Mapping and risk assessment

Under the auspices of the FSOR, the most critical financial sector business activities, processes and systems are being mapped and risk-assessed. Mapping and risk assessment of the interaction between Kronos, VP and the retail payment systems are key elements in this work.

1 For a description of Danmarks Nationalbank's oversight, see Danmarks Nationalbank, *Oversight Policy*, June 2015 ([link](#)).

The Danish payments infrastructure

Box 2

Every banking day, payments totalling kr. 524 billion are settled via the Danish payments infrastructure. The payments infrastructure is the network of systems that enables consumers, firms and public authorities to exchange payments. Some types of payment can be made 24/7/365, others only during bank opening hours. However, for all payments, final settlement and exchange of amounts between banks take place on banking days, i.e. when banks are open for business.

Danmarks Nationalbank's payment system, Kronos, plays a central role in the infrastructure, both in relation to settlement of large, time-critical payments between banks (interbank payments) and by virtue of Danmarks Nationalbank's role as settlement bank for other payment and settlement systems.

Totalling kr. 83 billion, interbank payments settle in Kronos every day.

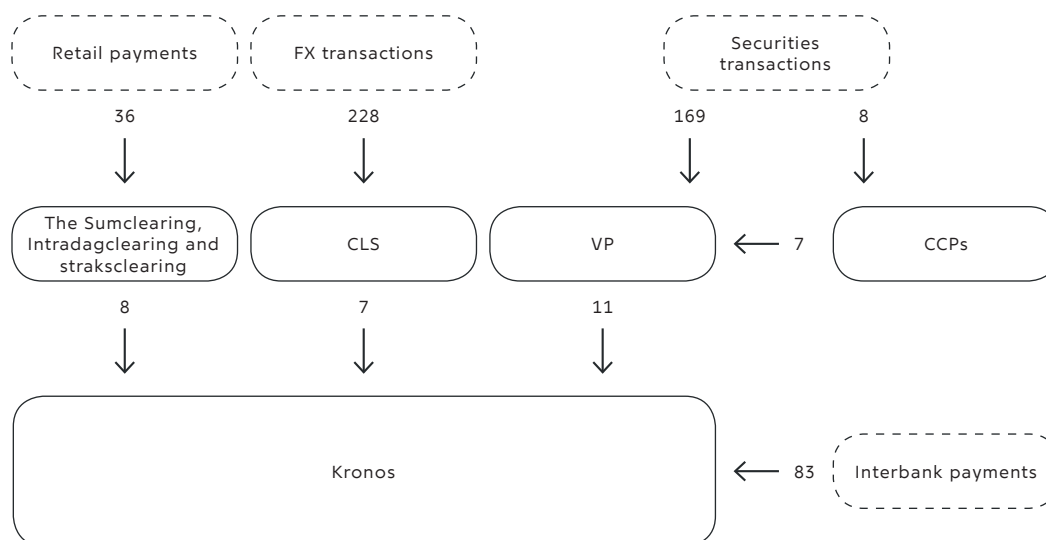
Retail payments are payments between consumers, firms and public authorities, e.g. by Dankort or as credit transfers. Depending on their type, retail payments are settled through the Sumclearing, the Intradagclearing or the Straksclearing.

Foreign exchange transactions in CLS comprise e.g. FX spot, FX forward and FX swap transactions.

Securities transactions in VP comprise trading in bonds, equities and investment fund shares. Some securities transactions, such as equity trades, are settled via a central counterparty, CCP. However, this applies to only a limited share of the total turnover.

The payment and settlement systems in the infrastructure, i.e. CLS and VP and the three retail payment systems (the Sumclearing, the Intradagclearing and the Straksclearing), settle their participants' net positions in Kronos. Net positions are calculated by offsetting participants' claims and obligations in the respective systems. Netting reduces the participants' liquidity requirement for settlement considerably compared with a situation in which all payments are settled individually, for instance netting reduces the daily liquidity requirement for the settlement of retail payments from kr. 36 billion to kr. 8 billion, equivalent to a reduction of 78 per cent. In CLS and VP, netting reduces the liquidity requirement by 97 per cent and 94 per cent, respectively.

Payment flows, billion kroner, averages per banking day in 2016



Interbank payments

Interbank payments are payments carried out between banks. Such payments are typically characterised by being time-critical and of high value, and hence they are settled in real-time gross settlement, RTGS, systems, where payments are settled individually and immediately.

Interbank payments in Danish kroner are settled in Danmarks Nationalbank's RTGS system, Kronos, which is also used for the settlement of monetary policy operations and net positions from connected payment and settlement systems.

Use

Kronos has 91 participants: 70 Danish banks, six mortgage banks, ten branches of foreign banks and five other participants.

In 2016, approximately 4,400 interbank payments were settled via Kronos every day, corresponding to kr. 83 billion. This is a decrease on 2015, cf. Table 1. The value of monetary policy operations in the form of sale of certificates of deposit and transfers to settlement systems also declined considerably in 2016, cf. below. However, these have increased again in the first quarter of 2017.

Activity in Kronos reflects activity in the financial sector, but is also affected by the monetary policy situation. In terms of monetary policy, 2016 was a calm year relative to 2015. This is reflected not only in a lower value of monetary policy operations, but also in interbank payments and transfers to settlement systems, both of which depend on the liquidity in the sector.

Payments in Kronos

Table 1

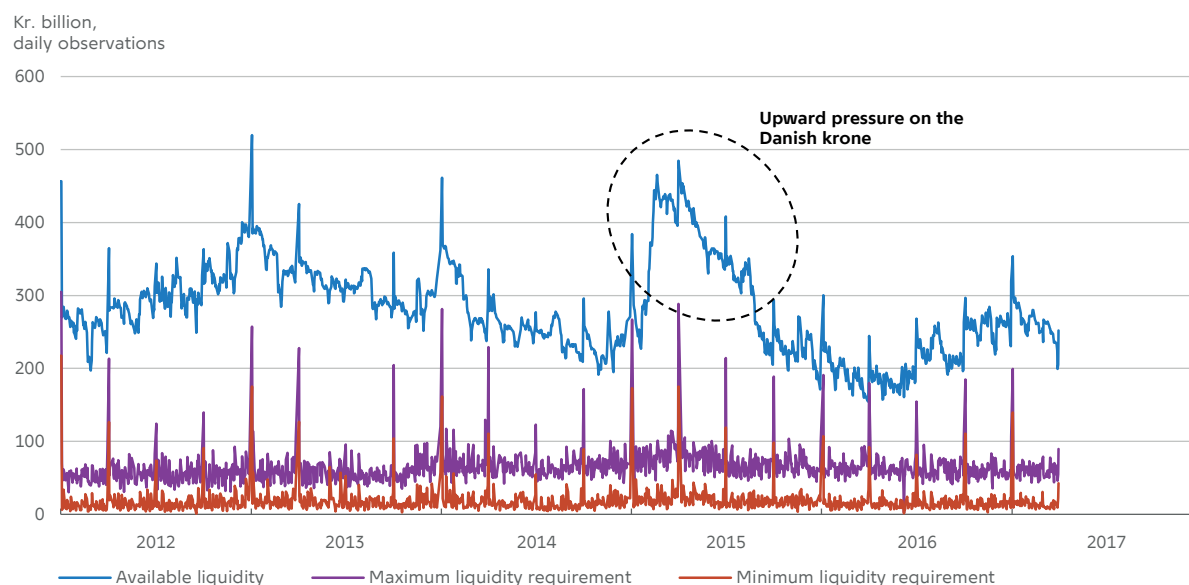
Kr. billion, averages per banking day	2013	2014	2015	2016	2017 Q1
Interbank payments	96.1	92.0	99.3	83.0	76.3
- Of which customer payments	10.3	11.0	12.8	11.5	11.8
Monetary policy operations	33.5	25.5	37.5	28.7	38.6
- Of which sale of certificates of deposit	33.4	24.9	37.3	28.6	38.6
- Of which monetary policy lending	0.2	0.6	0.2	0.1	0.0
Transfers to settlement systems	196.5	329.5	389.6	292.7	335.4
- Of which for the Sumclearing, Intradagclearing and Straksclearing	130.1	272.2	332.3	240.0	284.7
- Of which for VP settlement	44.7	40.9	40.8	37.0	35.9
- Of which for CLS	21.8	16.5	16.5	15.7	14.8
Net positions settled	21.7	25.8	27.6	25.1	24.7
- Of which the Sumclearing, Intradagclearing and Straksclearing	3.1	7.0	7.6	7.6	7.8
- Of which VP settlement	11.5	12.2	12.7	10.6	10.5
- Of which CLS	7.1	6.5	7.2	6.9	6.4

Note: Transfers to settlement systems comprise both traditional liquidity reservations from current accounts to settlement accounts and use of automatic collateralisation.

Source: Danmarks Nationalbank.

Participants' liquidity requirements in Kronos

Chart 1



Note: Available liquidity is the participants' total line plus their current account balances when Kronos opens at 7:00 am, from 24 June 2013 including amounts received in VP settlement cycle 30 at 7:05 am. The maximum liquidity requirement corresponds to the liquidity that the participants need for settlement of all that day's payments without delay. The amount depends on the sequence of the payments within the day. The minimum liquidity requirement is calculated as the liquidity that the participants need for settlement of all the day's payments after maximum netting of incoming and outgoing payments.

Source: Danmarks Nationalbank.

Operational reliability

Kronos uptime² exceeded 99.9 per cent in 2016, which is satisfactory. However, one incident caused the system uptime in one month to be lower than the agreed service level. On 20 September 2016, it was not possible to transmit payments via Kronos in the morning due to a SWIFT problem. The last queued payments were not settled until midday. In 2016, Kronos was also affected by a number of minor incidents that did not have any impact on its uptime. All system incidents have been followed up satisfactorily.

Liquidity

Overall, Kronos participants had ample liquidity for settlement of payments in 2016, cf. Chart 1, which

shows the participants' excess liquidity cover. However, participants' liquidity has normalised after the upward pressure on the krone subsided during 2015. Traditionally, the liquidity requirement is particularly high on days when auctions of fixed rate bullet bonds for financing adjustable rate mortgage loans are settled, i.e. typically at the start of the year and at the end of the quarterly settlement periods. The ample liquidity among Kronos participants contributed to smooth settlement of payments in 2016. In general, ample liquidity means that incidents and failures which prevent individual participants from settling payments have no impact on the settlement of other participants' payments in Kronos.

² The uptime is the technical uptime supplied by Kronos's IT service provider. Operational disruptions caused by other circumstances are not included.

International standards

In 2016, Danmarks Nationalbank published an assessment of Kronos in relation to the requirements in the CPMI-IOSCO principles. Kronos observes the vast majority of the requirements.³ Since Kronos is being replaced by Kronos2, the focus of the assessment is primarily on the administration related to the operation of an RTGS system, which will also apply to Kronos2.

Four areas with potential for improvement have been identified, which are expected to be addressed at the latest when Kronos2 goes live.

Danmarks Nationalbank is analysing the observance of the CPMI-IOSCO cyber guidance. Based on this analysis, a plan will be developed for closing any gaps identified.

System updates

Danmarks Nationalbank is replacing the systems that support Danmarks Nationalbank's handling of payments, collateralisation and monetary policy operations. Kronos will be replaced by a new RTGS and collateralisation system, Kronos2. This system is based on two standard systems: the Perago system (RTGS part), which is also used by Sveriges Riksbank and Norges Bank, among others, and the Calypso system, which will be the new collateral management system.

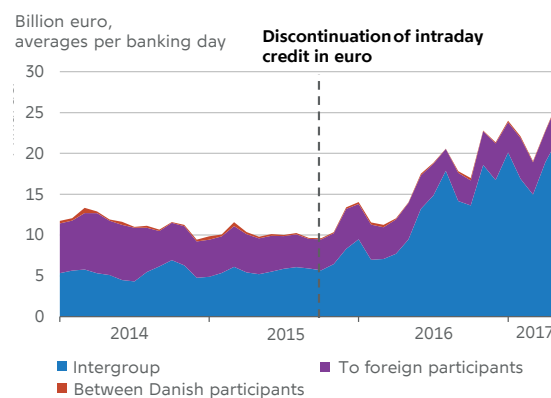
In March 2017, Danmarks Nationalbank decided to postpone the implementation of Kronos2. Reports by external service providers and cooperation partners pointed out technical faults and deficiencies that need to be corrected before the system goes live.

Interbank payments in euro

Denmark is connected to Target2, the trans-European RTGS system for settlement of payments in euro. Payments between financial institutions and transfers for settlement in other euro payment and settlement systems are settled in Target2.

Interbank payments in Target2

Chart 2



Note: The chart shows payments submitted by Danish participants via Target2. Daily averages have been calculated on a monthly basis.

Source: Danmarks Nationalbank.

Use

There are 29 Danish participants in Target2. In 2016, Danish participants' daily interbank payments averaged 18.1 billion euro, a substantial increase on 2015, cf. Chart 2. This rise should be seen in the context of the discontinuation of intraday credit in euro in October 2015 and the fact that participants may no longer hold overnight deposits in Target2. As a result, participants need to obtain euro liquidity in the morning and to place their liquidity outside Denmark at the close of the day, for instance with branches in the euro area. This is reflected in an increase in intergroup payments.

Danish participants use Target2 mainly for intergroup payments and payments to non-resident participants. Exchange of euro mostly takes place with participants in Germany, Finland, France and the Netherlands.

Operational reliability

The operational reliability of the local Target2 components for which Danmarks Nationalbank is responsible was satisfactory in 2016.

3 Cf. Danmarks Nationalbank, *Assessment of Kronos*, December 2016 ([link](#)).

In 2016, problems with automatic liquidity transfers from Target2-Securities at the close of the day continued, causing delays in the closing time of Target2 on several occasions. These incidents are being handled in the context of the oversight cooperation between participant member states, in which Danmarks Nationalbank is also represented.

System updates

Under the auspices of the ECB, work is ongoing to modernise the European payments infrastructure towards 2020. This project comprises three paths, relating to the modernisation of the Eurosystem's RTGS services, settlement of instant payments in euro, and a joint collateral management system.

With the modernisation of the Eurosystem's RTGS services, the system will be migrated to the more modern T2S platform, which will increase security and reduce operational costs. Moreover, development of new functionalities is being considered, e.g. for liquidity management, to the extent requested by market participants. This issue will be submitted for public consultation in the course of 2017.

Retail payments

Payments between consumers, firms and public authorities can be made using banknotes and coins or various payment solutions such as Dankort. A payment solution is used to initiate a payment, which is then settled in one of the retail payment systems, i.e. the Sumclearing, Intradagclearing or Straksclearing.

Operational reliability

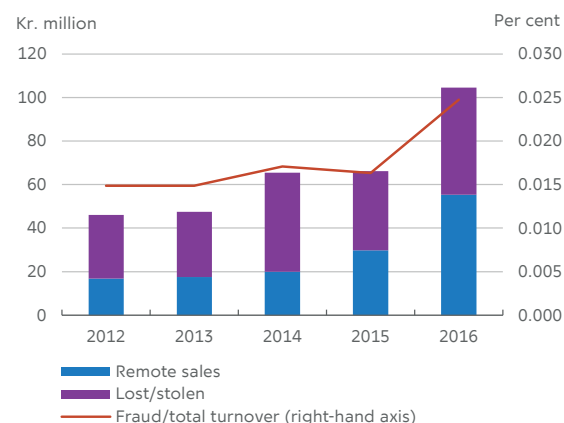
Nets owns Dankort and Betalingsservice, and hence Danmarks Nationalbank's oversight of these solutions focuses on Nets.

Overall, the operational reliability of Nets' systems was satisfactory in 2016. However, there were incidents where errors and system downtime affected the availability of the card system. One incident had value dating implications. In connection with failure of the card system, Nets encourages retailers to use the offline functionality of the card terminals so that payments can still be received.

In two press releases dated 27 September and 26 October 2016, Nets advised the banks to block

Dankort fraud, 2012-16

Chart 3



Note: Remote sales include online sales, mail orders, telephone orders and vending machines where PINs are not used. Fraud and turnover figures for 2014-16 have been compiled by Nets. Turnover figures for 2012-13 have been compiled by Danmarks Nationalbank. There are small methodological differences in the compilation of turnover figures by Danmarks Nationalbank and Nets. Source: Nets and Danmarks Nationalbank.

15,000 and 100,000 payment cards, respectively, including Dankort cards, due to suspicion of fraudulent use in a large foreign online store. Danmarks Nationalbank and Nets have discussed communication about incidents such as these.

One incident in 2016 affected the availability of Betalingsservice and had value dating implications.

The Nets follow-up on these incidents has been satisfactory.

Fraud and fraudulent use

In 2016, Dankort fraud accounted for 0.025 per cent of total turnover, cf. Chart 3. Although the incidence of fraud was higher than in 2015, it remains low in an international context, cf. the ECB's most recent report on fraud involving cards issued in the SEPA⁴,

4 The SEPA (Single Euro Payment Area) comprises 34 countries – the 28 EU member states plus Switzerland, Norway, Iceland, Liechtenstein, San Marino and Monaco.

according to which fraud constituted 0.04 per cent of total turnover in 2013.⁵

In absolute figures, Dankort fraud amounted to kr. 105 million in 2016. The Nets fraud department regularly assesses whether fraud or attempts at fraud are taking place. To counter fraud, Nets has launched a new initiative in 2017, a fraud prevention tool that applies advanced algorithms to analyse fraud tendencies and uses the results to predict fraud before it occurs.

Fraud in connection with remote sales, primarily online, rose by approximately 85 per cent from 2015 to 2016 and now constitutes more than half of the total fraud volume, even though remote sales account for only 20 per cent or so of total Dankort turnover. In 2017, Nets has implemented an online security solution, Dankort Secured by Nets, to increase security in connection with online purchases. Dankort Secured by Nets is a solution whereby the user must enter not only Dankort details but also a code received by text from Nets before finalising the purchase. This method, which is also used for purchases involving international cards, is used if the amount exceeds kr. 450.

Danmarks Nationalbank and Nets regularly discuss Dankort fraud and Danmarks Nationalbank follows up the effect of the new tools (the fraud prevention tool and Dankort Secured by Nets solution). At present, focus is mainly on the rise in fraud in connection with remote sales.

In 2015, Nets introduced a Dankort with contactless functionality. This functionality can be used for all physical transactions, provided that the terminal supports it. If the purchase sum is lower than kr. 200, a PIN is required only occasionally, while purchases exceeding kr. 200 must always be validated by a PIN. Fraudulent use of the contactless functionality is very limited.

Fraud related to credit transfers totalled approximately kr. 7.2 million in 2016, cf. Finance Denmark's online bank hacking statistics. In most cases, the fraud arises because the user is "persuaded" by IT criminals to disclose or enter data (ID, password

or key card code) via fake emails, text messages or phone calls, i.e. "social engineering".

International standards

Danmarks Nationalbank has assessed Dankort against the ECB standards for card payment schemes.⁶ The assessment is partly based on a self-evaluation by Nets. Moreover, Danmarks Nationalbank and Nets have had an ongoing dialogue about Nets' observance of the specific requirements in the standards and the underlying documentation.

The main conclusion of the assessment is that Dankort's performance is stable with a high degree of availability, and Dankort fraud is low by international comparison (see also above). In the assessment, Danmarks Nationalbank inter alia recommends that Nets' risk analyses of the Dankort IT platform be expanded to include a risk assessment of all relevant aspects of Dankort. Other recommendations relate to a more systematic knowledge management at Nets regarding Dankort and a strengthening of the framework for decision-making and communication regarding Dankort.

Nets has indicated to Danmarks Nationalbank that work is being carried out to observe all of the recommendations in the assessment.

Danmarks Nationalbank regularly discusses oversight of the most important payment solutions with the Danish Financial Supervisory Authority in order to avoid overlapping regulatory control.

Regulation

The framework conditions for payments are changing these years. At the end of 2015, the European Parliament and the Council adopted a new Payment Services Directive, PSD2, which replaces the Payment Services Directive from 2007. PSD2 modernises the rules governing payment services. Against that background, the Danish Financial Supervisory Authority in early 2017 submitted a "payments bill" for consultation.⁷ When enacted, it will implement PSD2 and replace the existing Payment Services and Electronic Money Act.

⁵ ECB, *Fourth Report on Card Fraud*, July 2015 ([link](#)).

⁶ Dankort Assessment ([link](#))

⁷ Consultation on payments bill ([link](#)). Danmarks Nationalbank has submitted a consultation response ([link](#)).

Settlement of retail payments

The Sumclearing, Intradagclearing and Straksclearing are the financial sector's systems for clearing and settlement of Danish retail payments. The systems are owned by Finance Denmark, which has appointed Nets as operator of the systems.

The Sumclearing and the Intradagclearing are net settlement systems. The Sumclearing is used for settlement of e.g. card payments and Betalings-service. The Intradagclearing is used for settlement of credit transfers, including wages and salaries.

The Straksclearing is a real-time settlement system for payments of up to kr. 500,000, with instant exchange of funds between customers. This is possible because the banks have prefunded the transfers. The Straksclearing is used for credit transfers executed as instant payments or via MobilePay.

Use

There are 50 direct participants in the retail payment systems and 36 indirect participants, who settle via direct participants. The average transaction volume in the retail payment systems was kr. 36.4 billion per banking day in 2016. The breakdown of transactions on the Sumclearing, the Intradagclearing and the Straksclearing can be seen in Table 2.

The number of Straksclearing transactions rose by 57 per cent from 2015 to 2016, cf. Chart 4. The increase is mainly attributable to MobilePay being settled in the Straksclearing. Statistics show⁸ that more than 3.4 million Danes use MobilePay.

The rising number of instant payments has not led to an equivalent fall in the number of Intradagclearing transactions, cf. Chart 4. This indicates that instant payments, including payments via MobilePay, are to some extent replacing cash payments and have led to a change in payment patterns.

Although there has been an increase in the number of instant payments, the total value of these transactions remains modest. Some 40 per cent of Straksclearing transactions are smaller than kr. 100, while

Payments in the Sumclearing, Intradagclearing and Straksclearing

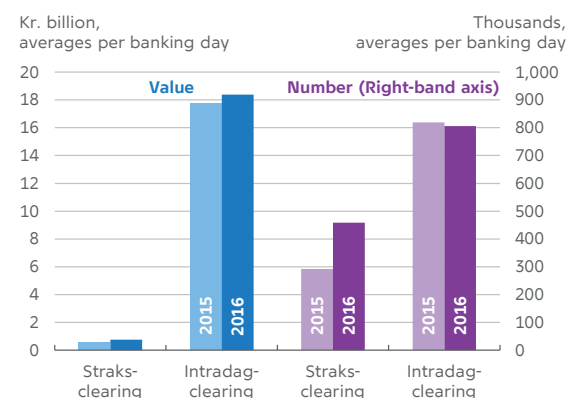
Table 2

Kr. billion averages per banking day	2012	2013	2014	2015	2016
Sumclearing	32.2	29.1	17.9	16.7	17.2
Intradagclearing	-	13.8	17.0	17.8	18.4
Straksclearing	-	-	0.5	0.6	0.8
Total	32.2	42.9	35.4	35.0	36.4

Source: Nets.

Payments in the Intradagclearing and Straksclearing, 2015-16

Chart 4



Source: Nets.

8 <https://www.mobilepay.dk/da-dk/Pages/The-story-in-English.aspx>.

Intradagclearing transactions are typically somewhat larger, cf. Chart 5.

Operational reliability

Retail payment system operations were satisfactory in 2016. There were fewer system incidents than in 2015. However, there were a few incidents that Danmarks Nationalbank has discussed with Finance Denmark. It is assessed that satisfactory measures have been taken to avoid recurrence.

Liquidity

Participants' net positions in the Sumclearing, Intradagclearing and Straksclearing are settled in accounts at Danmarks Nationalbank at fixed times during the day. In 2016, participants generally had considerable excess liquidity for settlement of retail payments. One of the reasons was that nearly all participants use at least one of the automated liquidity management tools introduced with the Intradagclearing in 2013. In 2016, there were few cases where participants had reserved insufficient liquidity for settlement so that delays occurred. These incidents subsequently led to sanctions against the participants in question.

International standards

Danmarks Nationalbank is currently assessing the retail payment systems in relation to the CPMI-IOSCO principles. The point of departure is Finance Denmark's self-assessment of the systems, combined with an ongoing dialogue.

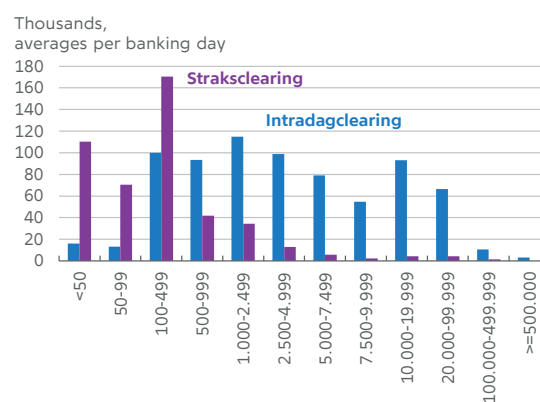
In July 2016, Danmarks Nationalbank recommended that Finance Denmark perform an analysis of the retail payment systems' observance of the CPMI-IOSCO cyber guidance. Finance Denmark will initiate this analysis when the above assessment of the retail payment systems has been completed.

System updates

When the Danish krone joins T2S in the autumn of 2018, the monetary policy day will be changed. Longer opening hours in Kronos will enable later settlement in the retail payment systems. Consequently, Finance Denmark and the participants have decided to postpone the last Intradagclearing settlement cycle from 2 pm to 3:30 pm. This will allow a larger share of transactions to be settled within the same day. In addition, the liquidity requirement for night-time settlement will be reduced. It has also been decided to move the day's last exchange of liquidity between Straksclearing participants from

Number of payments in the Intradagclearing and Straksclearing by value, 2016

Chart 5



Note: The Straksclearing is used for payments of up to kr. 500,000.

Source: Nets.

2:30 pm to 4 pm. And finally, it is being considered whether the exchange of liquidity at 1:20 pm should be moved to 2:50 pm so that it is placed in advance of the Intradagclearing settlement.

In 2016, Finance Denmark transferred administrative tasks in connection with the retail payment systems to the sector-owned company e-nettet. e-nettet is responsible for day-to-day administration of the systems, including the work to facilitate the governance, risk management, supplier management, etc.. Ownership and ultimate decision-making powers in relation to the systems will still be vested in Finance Denmark.

Securities Settlement

VP settlement is the Danish securities settlement system. VP Securities A/S, VP, also undertakes registration of ownership of securities and handling of periodic payments, issues, redemptions, etc.

Use

VP has 143 clearing and settlement participants, of which 59 are non-resident market participants. Securities transactions totalling an average of kr. 175.9

Equities, investment fund shares and bonds settled in VP

Table 3

Year, daily averages	Total		Bonds		Equities		Investment fund shares	
	Number of trades, thousands	Value, kr. billion	Number of trades, thousands	Value, kr. billion	Number of trades, thousands	Value, kr. billion	Number of trades, thousands	Value, kr. billion
2012	40.1	193.7	4.1	174.0	19.8	15.9	16.2	3.8
2013	51.5	172.0	3.3	146.1	25.7	21.3	22.5	4.6
2014	61.1	178.2	3.1	144.4	32.3	28.2	25.6	5.6
2015	67.1	206.2	3.4	158.5	33.4	41.4	30.2	6.3
2016	63.6	175.9	2.8	131.8	30.9	37.6	29.9	6.6

Note: Values have been calculated on the basis of the securities leg of a trade, i.e. the market value of the securities transferred from the seller to the buyer.

Source: vp.dk.

billion per banking day were settled in 2016, cf. Table 3, a fall of 15 per cent relative to 2015. The decline was strongest for bonds, while the value of investment fund shares settled continued its upward trend from the previous years. The lower volume of bond transactions in 2016 should be viewed in the light of a very high volume in early 2015 due to increased demand for Danish securities in the period with upward pressure on the krone.

Operational reliability

VP system uptime⁹ was 99.9 per cent in 2016, which was a little higher than in 2015. Three incidents on 9 March, 4 April and 13 September, respectively, led to system downtime, while VP availability was 100 per cent on all other days in 2016. Following VP's connection to T2S, there have also been several delays in T2S that have affected VP, cf. below. These delays have not had any impact on VP availability, but in several cases they have delayed night-time settlement. Danmarks Nationalbank monitors VP incidents in order to assess operational risks, including those relating to VP's dependence on technical service providers such as T2S.

Overall, the operational reliability of the VP settlement system is assessed to have been satisfactory in 2016. VP has followed up the above incidents in a timely manner, and their consequences have been limited. Furthermore, VP is working to reduce the risk resulting from its dependence on T2S.

Settlement ratio

As a main rule, securities transactions must be settled two days after the transaction date. The settlement ratio indicates the percentage, in value terms, of the transactions settled in a timely manner. In 2016, the overall settlement ratio in VP was 98.9 per cent, corresponding to the level in the previous year, cf. Chart 6. If VP settlement participants' ratios remain too low for a prolonged period of time, sanctions, including fines of up to kr. 100,000, will be imposed. In 2016, one fine was issued.

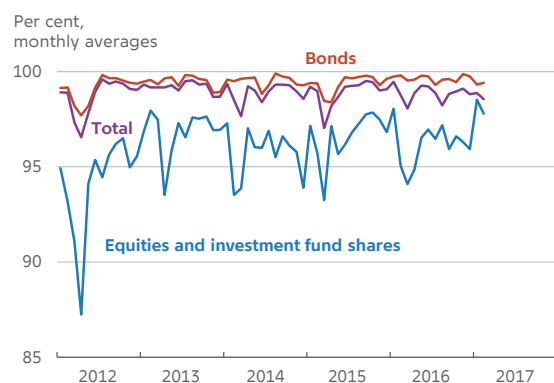
Liquidity

VP participants reserve liquidity in accounts at Danmarks Nationalbank for VP's net settlement cycles. If VP's checks for adequate cover show that the buyer does not have sufficient liquidity, the reported

9 The uptime is the technical uptime supplied by VP's IT service provider.

Settlement ratios in VP

Chart 6

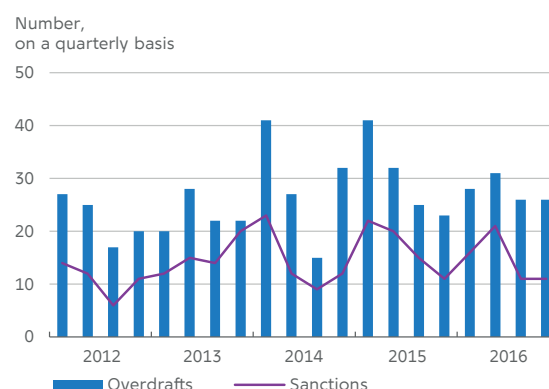


Note: In the chart, the settlement ratios are stated on the basis of settlement values. For equities and investment fund shares, the settlement ratio has been calculated as a weighted average of the two types of securities, while the total is a weighted average for all types of securities.

Source: VP.

Overdrafts and sanctions in VP settlement

Chart 7



Note: A participant is fined only if the overdraft is the participant's own fault. In other words, no fine is imposed if the overdraft is due to non-payment by another participant who has reserved insufficient liquidity for settlement.

Source: VP.

purchases will, as a main rule, be postponed until the subsequent settlement cycle. Participants who have overdrawn their liquidity lines may be fined. The size of the fine depends on how many times the participant has overdrawn its liquidity line within the last six months. In 2016, there were a total of 111 overdrafts in VP, and 59 fines were issued, cf. Chart 7. This was a lower number of overdrafts than in 2015. Danmarks Nationalbank monitors developments in the number of overdrafts with a view to assessing the efficiency of the sanctioning regime.

International standards

VP observes the vast majority of the requirements in the CPMI-IOSCO principles. That was the conclusion in the assessment published by Danmarks Nationalbank and the Danish Financial Supervisory Authority in 2016.¹⁰ In the assessment, four recommendations were made to VP. Danmarks Nationalbank is currently assessing the measures implemented by VP in order to comply with the recommendations. It will

not be possible to finally assess the recommendations linked to legislative requirements until VP has applied to the Danish Financial Supervisory Authority for authorisation as a central securities depository and securities settlement system, cf. the CSDR¹¹. VP expects to submit the application in the 2nd quarter of 2017.

In the autumn of 2016, VP performed an analysis of its observance of the CPMI-IOSCO cyber guidance. Against the background of the analysis, VP has launched a number of cyber initiatives.

System updates

Over the weekend of 10-11 September 2016, VP was connected to Target2-Securities, T2S, a trans-European securities settlement system, cf. below. This was a milestone for VP, which had been working on the project for 10 years. For example, VP had to adapt its systems to 24 initiatives to ensure harmonisation across central securities depositories in

10 Assessment of VP Securities, April 2016 ([link](#)).

11 Regulation (EU) No. 909/2014 of the European Parliament and of the Council of 23 July 2014 on improving securities settlement in the European Union and on central securities depositories, etc.

Europe. Initially, VP settlement in euro will take place via T2S. The next milestone will be VP's connection to T2S for settlement in Danish kroner. VP, Danmarks Nationalbank and the ECB are currently negotiating the practicalities in this connection. Danish kroner are expected to be settled from October 2018.

Besides joining T2S, VP has concluded an agreement with Sveriges Riksbank for settlement of securities transactions, etc. in Swedish kronor in VP. This solution was implemented in March 2017. With effect from April 2017, VP no longer offers settlement in Icelandic kronur, and night-time settlement in euro in VP's systems was discontinued at the same time. Instead, settlement in euro mainly takes place on T2S.¹²

Target2-Securities

In September 2016, VP was connected to TARGET2-Securities, T2S, a trans-European securities settlement system owned by ECB. Initially, VP has joined T2S for settlement in euro. The purpose of T2S is for cross-border securities transactions to be handled as safely, inexpensively and efficiently as domestic transactions. A total of 18 central securities depositories from 16 countries now settle via T2S, including VP, cf. Box 3. So far, the euro is the only T2S settlement currency, but from October 2018 Danish kroner are expected to be settled in the system.

12 Danish banks currently hold T2S settlement accounts at Danmarks Nationalbank so that they are direct participants in T2S cash settlement. Since Danmarks Nationalbank no longer has a euro facility, a bank that wants direct access to liquidity in euro for settlement in T2S must open an account with a central bank in the euro area via a branch in that member state. Three Danish banks have chosen to do so. The other banks have concluded agreements with correspondent banks.

CCP clearing

In Denmark, certain securities transactions are settled via a central counterparty, CCP. A CCP positions itself between the parties to the transaction, assuming the risk for both the buyer and the seller from the transaction date until the transaction has been finally settled. So if either of the parties to the transaction defaults within this period, the CCP still has an

Securities settlement systems and depositories on T2S and their connection dates

Box 3

- June/August 2015:
BOGS (GR), Depozitarul Central (RO), Malta Stock Exchange, SIX SIS (CH), Monte Titoli (IT)
- March 2016:
- Interbolsa (PT), NBB-SSS (BE)
- September 2016:
Euroclear ESES (FR, BE, NL), VP (DK), VP Lux (LU)¹
- February 2017:
CDCP (SK), Clearstream (DE), KDD (SI), KELLER (HU), LuxCSD (LU), OeKB CSD (AT)
- September 2018:
Baltic CSDs (EE, LV, LT), Iberclear (ES)

¹ VP Lux is a VP subsidiary that operates as a central securities depository in Luxembourg.
Source: ECB.

¹² It will still be possible to settle in euro in VP's own systems in cycle 50 at 2:15 pm.

obligation to the other party. However, this means that risk is concentrated in the CCP, and therefore the CCP is subject to a number of regulatory requirements to ensure the completion of the transaction.¹³

In Denmark, EuroCCP, LCH Clearnet and Six X-clear clear equities transactions, while Nasdaq Clearing clears repo transactions. After CCP clearing, transactions are settled in VP. Ongoing supervision to ensure that CCPs comply with the regulatory requirements is conducted by the national competent authority in cooperation with supervisory colleges, comprising representatives from both supervisory authorities and central banks from the CCP's most important markets. Danmarks Nationalbank monitors developments, e.g. via its participation in the EuroCCP supervisory college.

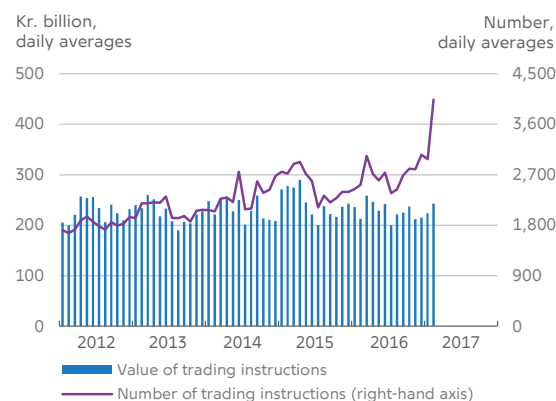
Settlement of foreign exchange transactions

A foreign exchange transaction consists of two opposite payments in two different currencies.¹⁴ Traditionally, foreign exchange transactions are settled as two independent payments, often executed via correspondent banks in the currencies in question. In the international foreign exchange clearing and settlement system, CLS, settlement of the two payments takes place simultaneously (Payment versus Payment, PvP). This mitigates the settlement risk. CLS is owned by large, international banks and settles transactions in 18 participating currencies, including Danish kroner.

Oversight of CLS is carried out by a joint CLS Oversight Committee, which is a forum for cooperation between the central banks of the participating currencies. Danmarks Nationalbank participates in this work, which is organised by the Federal Reserve, Fed. The Fed is also the supervisory authority for CLS.

Trading instructions in CLS

Chart 8



Note: Daily averages calculated on a monthly basis. On 23 January 2017 CLS has changed the threshold amount for which a trade is split into several instructions. This has led to a higher number of instructions per day.

Source: CLS Bank.

Use

There are four settlement members participating directly in the CLS settlement of Danish kroner, while a large number of financial institutions and firms participate indirectly in the CLS settlement via one of the settlement members. More than 80 per cent of all foreign exchange transactions in Danish kroner are settled via CLS.¹⁵

In 2016, the number of transactions continued the upward trend seen in previous years, while the value remained stable, cf. Chart 8. The average daily value of CLS transactions was kr. 228 billion in 2016. On the first banking day in the 4th quarter of 2016, 3 October, CLS settlement set a new record in Danish kroner, reaching kr. 606 billion and 7,136 trading instructions.

13 Cf. Regulation (EU) No 648/2012 of the European Parliament and of the Council of 4 July 2012 on OTC derivatives, central counterparties and trade repositories ([link](#)).

14 For example, trading kroner against euro entails a payment in kroner by one party to the other and an opposite payment in euro.

15 BIS, *Triennial Central Bank Survey – Foreign exchange turnover in April 2016* ([link](#)), CLS Bank.

Operational reliability and liquidity

Pay-ins to CLS take place via the national RTGS systems; in the case of Danish kroner via Kronos. Hence the operational reliability of CLS depends on the stability of the RTGS systems. In 2016, there were no Kronos incidents that affected key business deadlines for CLS settlement.

CLS is operationally stable and formalised procedures for incident management have been established. In 2016, there were few incidents related to Danish kroner. Incidents can be attributable to various factors such as delayed pay-ins from participants or RTGS incidents. The Danish participants reserve sufficient liquidity for CLS settlement.

International standards

Oversight of CLS is based on the CPMI-IOSCO principles. Danmarks Nationalbank's oversight is focused on matters of importance to the settlement of transactions in Danish kroner.

CLS has published an updated disclosure of the system's observance of the CPMI-IOSCO principles.¹⁶

System updates

CLS has initiated the development of a standardised, automated bilateral netting service, CLSNet¹⁷, aimed at FX transactions settled outside CLS. The service will be open for more than 140 currencies.

16 CLS, Principles for Financial Market Infrastructures – Disclosure, 2016 ([link](#)).

17 CLS, CLSNet ([link](#)).



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FINANSIAL STABILITY