

Oversight of the financial infrastructure 2024

Danmarks Nationalbank oversees the systems and solutions in the Danish financial infrastructure that enable consumers and businesses to exchange payments and securities. In this report, Danmarks Nationalbank presents the conclusions from its oversight operations in 2024.

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Denmark has a secure, efficient and stable payments infrastructure

Disruptions in the exchange of payments and settlement of securities transactions in Denmark are rare. The central systems and solutions in the infrastructure are highly compliant with the requirements of international standards for organisation, risk management and contingency planning, among other things.



System owners are continuously working to protect themselves against cyberattacks

System owners generally have a high level of maturity when it comes to cyber resilience. However, the evolving threat landscape means that there is an ongoing need to adapt and further strengthen resilience.



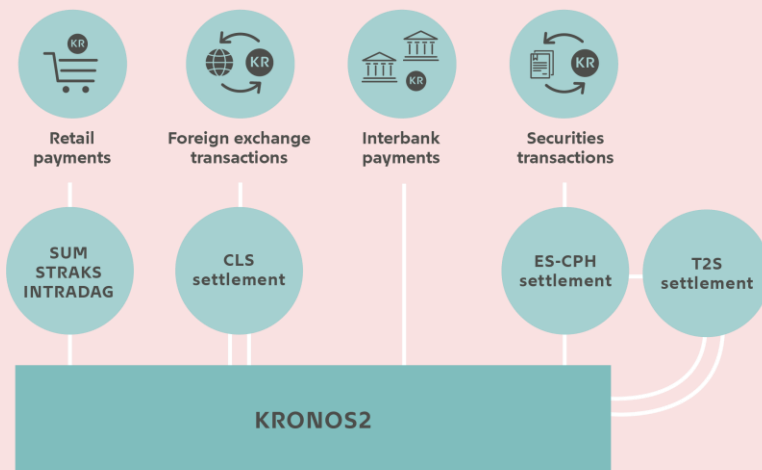
Infrastructure must prepare for extreme scenarios

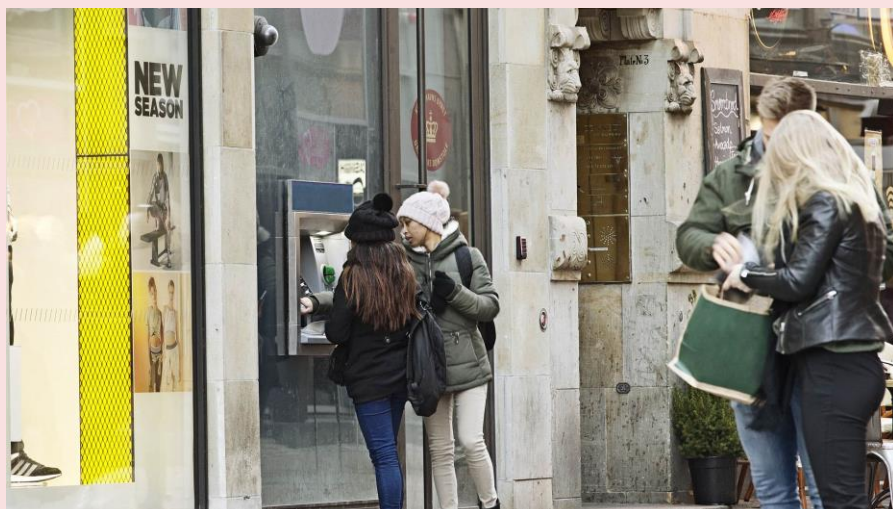
It is impossible to fully guard against cyberattacks. Therefore, Danmarks Nationalbank recommends that system owners prepare to be able to handle extreme but plausible scenarios, including being able to restore operations quickly and safely even after an extreme situation.

Why is it important?

On an average banking day in 2024, payments totalling kr. 732 billion are sent through the systems that make up the Danish payments infrastructure, and it is crucial for the economy that payments and securities can be exchanged without problems. That is why Danmarks Nationalbank oversees that central systems and solutions in the payments infrastructure function securely and efficiently and that they comply with international standards in this area. This helps fulfil one of Danmarks Nationalbank's main purposes, which is to contribute to safe and efficient payments.

Main chart: Danmarks Nationalbank oversees the central systems and solutions in the payments infrastructure





Keywords

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Oversight

Cyber security

Financial stability

01 Summary and assessment

The payments infrastructure in Denmark consists of a number of interconnected systems and solutions that enable consumers, businesses and financial entities to exchange payments and securities with each other. Every day, almost kr. 732 billion worth of payments are sent through the payments infrastructure, and it is crucial for the economy that systems and solutions function without disruptions and breakdowns, ensuring that it is easy and efficient to pay for goods and services.

Danmarks Nationalbank oversees that the central systems and solutions in the payments infrastructure are well-functioning, secure and efficient. As part of this task, Danmarks Nationalbank assesses whether the overseen systems and solutions comply with the high security and efficiency requirements of international standards, including cyber resilience requirements. In case of non-compliance, Danmarks Nationalbank recommends changes to systems and solutions as required. Danmarks Nationalbank's oversight is described in more detail in box 1.

BOX 1

Danmarks Nationalbank's oversight in 2024

Danmarks Nationalbank oversees the core systems and solutions in the Danish payments infrastructure:

- Kronos2 (interbank payments)
- Sumclearing, Intradagclearing and Straksclearing (retail payments)
- Euronext Securities Copenhagen's settlement system (securities transactions)
- Dankort, Betalingsservice and account-to-account transfers (the most important payment solutions)
- International systems relevant in Denmark (TARGET Services and CLS).

Danmarks Nationalbank's oversight is based on international standards and guidelines on security and efficiency. Danmarks Nationalbank oversees the core Danish payment and settlement systems based on CPMI-IOSCO's¹ *Principles for Financial Market Infrastructures*, PFMI², and PFMI's supplementary *Guidance on Cyber Resilience for Market Infrastructures*³. Danmarks Nationalbank's oversight also includes the ECB's *Cyber resilience oversight expectations*⁴, CROE, which implements the PFMI guidelines for cyber resilience in the ECB's oversight work. Oversight of the most important payment instruments in Denmark complies with the ECB's framework for oversight of payment instruments, PISA⁵. The organisation of the oversight is described in more detail in Danmarks Nationalbank's oversight policy⁶.

Danmarks Nationalbank coordinates with the Danish Financial Supervisory Authority in this area. This collaboration is designed to ensure that duplicate regulatory controls are avoided, skills are utilised in the respective authorities and relevant information is shared.

Danmarks Nationalbank collaborates with other central banks on overseeing international systems relevant to Denmark.

¹The Committee on Payment and Market Infrastructures, CPMI, is based at the Bank for International Settlements, BIS. The International Organization of Securities Commissions, IOSCO, is an international forum of cooperation between regulators of securities markets.

²See CPMI-IOSCO, *Principles for financial market infrastructures*, 2012 ([link](#)).

³See CPMI-IOSCO, *Guidance on cyber resilience for financial market infrastructures*, 2016 ([link](#)).

⁴See ECB, *Cyber resilience oversight expectations for financial market infrastructures*, 2018 ([link](#)).

⁵See ECB, *The Eurosystem Oversight Framework for Payment Instruments, Schemes and Arrangements, PISA*, 2021 ([link](#)).

⁶See nationalbanken.dk, *Oversight policy*, 2024 ([link](#)).

The Danish payments infrastructure is described in box 2. Here, the changes that have taken place in the infrastructure due to Danmarks Nationalbank moving the settlement of Danish kroner to the pan-European payment and securities settlement platform TARGET Services in Easter 2025 are also described.

BOX 2

The payments infrastructure in Denmark

Every banking day¹ in 2024, on average, kr. 732 billion worth of payments were sent through the Danish payments infrastructure, corresponding to around a quarter of GDP.

Danmarks Nationalbank's payment system plays a key role in the infrastructure for the settlement of large, time-critical payments between banks (interbank payments) and by virtue of Danmarks Nationalbank's role as settlement bank for the other payment and settlement systems. In Easter 2025, Danmarks Nationalbank transferred the settlement of Danish kroner from its own settlement system, Kronos2, to the pan-European platform for settlement of payments and securities transactions, TARGET Services².

TARGET Services, owned by the European Central Bank, ECB, and the national central banks of the euro area, consists of three services:

- T2 (formerly TARGET2), a payment system for large time-critical payments between participants and settlement of net positions from connected payment and settlement systems
- T2S (TARGET2-Securities), the securities settlement system
- TIPS (TARGET Instant Payment Settlement), which is used for instant payments.

Denmark has its own monetary policy and collateral management, which is still handled in Danmarks Nationalbank's system for collateral and monetary policy instruments, SPI. The collective name for the new payments infrastructure, which includes both TARGET Services and SPI, is TARGET DKK. Danmarks Nationalbank is the system owner of TARGET DKK and has entered into an agreement with the ECB on the use of TARGET Services.

The Danish payments infrastructure as it appeared in 2024 is shown in chart A, while the payments infrastructure as it will be after Easter 2025 is shown in chart B.

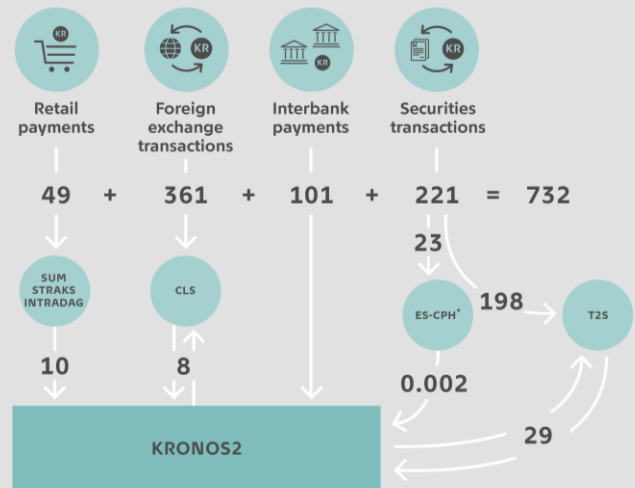
Retail payments are payments between consumers, businesses and public authorities, e.g. using payment cards and credit transfers. Depending on the type, payments are settled and reconciled in one of the financial sector's retail payment systems. The participants' accounts at Danmarks Nationalbank are then credited. Before Easter 2025, the payments were calculated and reconciled in the Sumclearing, Intradagclearing and Straksclearing (the Danish retail payment systems) owned by Finance Denmark and subsequently settled in Kronos2. After Easter 2025, net positions from the Sumclearing and Intradagclearing are now settled in TARGET DKK via T2. Instant payments will be settled after Easter 2025 through TIPS. In TIPS, all instant payments are settled individually and in real time. Danmarks Nationalbank is the system owner of TIPS-DKK. TIPS-DKK has replaced Straksclearing, which is now closed.

Securities transactions may be carried out in different ways: On the stock exchange, through a multilateral trading facility or bilateral trades via a bank or broker (also called "over-the-counter"). The settlement of transactions in Danish-issued securities is handled by the central securities depository, Euronext Securities Copenhagen, ES-CPH. Securities transactions between banks and their own customers are settled via ES-CPH's own settlement system, the ES-CPH settlement, while securities transactions between banks and other financial institutions are settled via T2S.

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CHART A

Payment flows, kr. billion, average per banking day in 2024

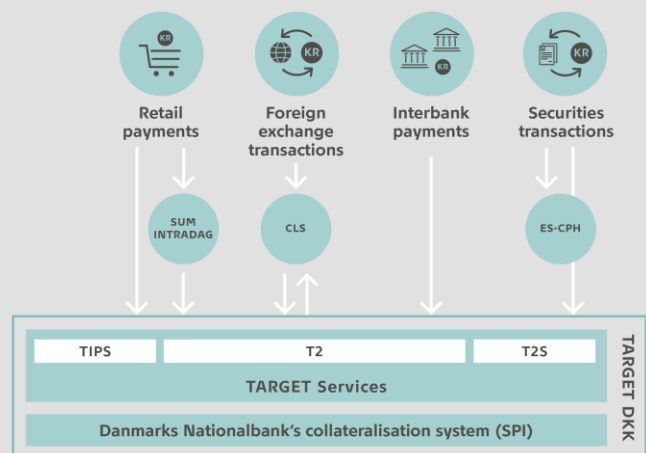


Note: * The majority of trades in ES-CPH are transactions in which no money is exchanged between the parties in Kronos2.

Source: Danmarks Nationalbank.

CHART B

The Danish payments infrastructure after Easter 2025



Source: Danmarks Nationalbank.

... continued

As the central securities depository, ES-CPH is responsible for keeping continuous records of the holdings of all Danish-issued securities on behalf of investors, and transfers of securities in accounts on T2S are subsequently reflected in accounts in ES-CPH's systems. Settlement of securities trades has been carried out in Danish kroner on T2S via Kronos2 since 2018. The transition to TARGET DKK has therefore only resulted in minor adjustments.

Foreign exchange transactions are settled through CLS, an international system for settlement of foreign exchange transactions, currently in 18 connected currencies, including Danish kroner. Danmarks Nationalbank makes accounts available to banks settling transactions through CLS. Participants reserve liquidity for CLS settlement by transferring funds to these accounts. Before Easter 2025, participants reserved liquidity for the settlement of foreign exchange transactions in CLS on accounts in Kronos2. After Easter 2025, liquidity is reserved in TARGET DKK via T2. CLS is owned by a number of large international banks.

Netting has a major impact on payment processing

In 2024, the three retail payment systems settled their participants' net positions in the participants' accounts in Kronos2. Net positions are calculated by offsetting participants' claims and obligations in the respective systems. This so-called netting reduces the participants' liquidity needs significantly compared to a situation where all payments are settled individually. For example, netting reduces the liquidity need for settlement of retail payments from kr. 49 billion to kr. 10 billion daily, corresponding to a reduction of 80 per cent. T2S settlement also takes place using netting. Liquidity for T2S settlement is transferred from the participants' cash accounts at Danmarks Nationalbank. Netting reduces the participants' need to reserve liquidity from kr. 198 billion to kr. 29 billion, which corresponds to a 85 per cent reduction.

¹ Some types of payments can be made on all days and at any time, others only when banks are open. But for all payments, final settlement and exchange of amounts between banks take place on banking days, i.e. days when banks are open for business.

² See nationalbanken.dk, *Memo on TARGET DKK*, October 2024 ([link](#)).

The infrastructure is safe, efficient and stable

Danmarks Nationalbank's oversight shows that the Danish payments infrastructure is safe and efficient.

The central systems and solutions in the infrastructure are highly compliant with the requirements of international standards for organisation, risk management and contingency planning. The owners of the systems and solutions generally have a high level of maturity when it comes to operational stability and cyber resilience. However, the evolving threat landscape means that there is an ongoing need to strengthen the resilience, see below.

In 2024, the operational stability of the infrastructure was generally high, and disruptions to the exchange of payments and settlement of securities transactions in Denmark are rare. In 2024, there were a few issues with the timely settlement of payments, and Danmarks Nationalbank's oversight has followed up with the system owners to ensure that the response to the incidents is satisfactory.¹

The infrastructure was also not significantly affected by the CrowdStrike incident in July 2024, which caused system crashes on approximately 8.5 million Windows

¹ The incidents and subsequent follow-up are described in detail below in the sections on the respective systems.

devices across the world, including the financial, aviation and healthcare sectors. Critical infrastructure operations are not dependent on Windows systems, so the incident had limited impact here. The incident was caused by a security software update from the vendor CrowdStrike.

The infrastructure is continuously working to increase cyber resilience

The cyber threat remains high and is constantly evolving. The threat landscape is influenced by changes in the geopolitical situation and the development of new technology, such as artificial intelligence. Furthermore, hackers are continuously becoming more skilled and specialised. The Centre for Cybersecurity assesses that the threat to the financial sector and financial infrastructure is persistent.²

The threat of cyberattacks means that the owners of the systems and solutions in the infrastructure must continuously work to strengthen their cyber resilience to stay ahead of the curve as the threat landscape changes and cybercriminals develop new methods.

The international standards³ in this area set requirements for cyber resilience work in a number of focus areas, see box 3.

BOX 3

Cyber resilience is strengthened through a continuous and holistic approach to cyber risk management

Danmarks Nationalbank assesses the resilience of the central systems based on CPMI-IOSCO's *Guidance on cyber resilience for financial market infrastructures, Cyber Guidance*¹, and ECB's *Cyber resilience oversight expectation for financial market infrastructures, CROE*².

The standards set requirements for systems to work with cyber resilience in the following areas:

- **Governance** that defines cyber resilience frameworks, roles and responsibilities
- **Identification** of critical business activities, the supporting processes, procedures and systems and their risk assessments
- **Protection** through effective security controls and process design
- Early **detection** of cyber incidents through monitoring
- **Respond** to attacks and **recover** critical business operations quickly and securely after a severe and widespread outage.

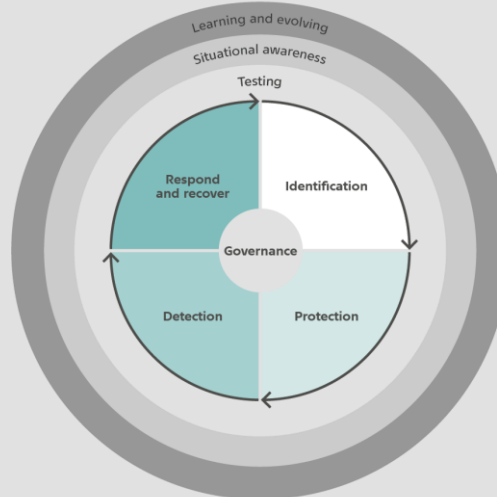
There are also requirements for working with three cross-cutting elements:

- **Testing** across all areas to ensure the efficiency of the work
- **Situational awareness**, including intelligence on the cyber threat landscape and vulnerabilities
- **Learning and development** to continuously strengthen cyber resilience, as the threat landscape also evolves.

It's important that system owners continuously focus on all areas to strengthen cyber resilience, see chart.

CHART

The five main focus areas and the three cross-cutting elements of cyber resilience



Source: CPMI-IOSCO, *Guidance on cyber resilience for financial market infrastructures, Cyber Guidance*. ECB, *Cyber resilience oversight expectations for financial market infrastructures, CROE*.

¹ See CPMI-IOSCO, *Guidance on cyber resilience for financial market infrastructures, 2016 (link)*.

² See ECB, *Cyber resilience oversight expectations for financial market infrastructures, 2018 (link)*.

² See the Centre for Cybersecurity, *The cyber threat to the financial sector, 1 November 2024 (link)*.

³ CPMI-IOSCO Cyber Guidance, CROE and PISA.

When working with cyber resilience, system owners should start by *identifying* the critical business processes and the supporting IT systems. These must be *protected* with effective security controls. Those responsible must be able to *detect* any unauthorised access to or interference with the systems, should it occur. They must be able to *respond* to the situation and limit the damage as much as possible, and finally, they must be able to safely *recover* the systems to normal operations if systems have been affected by a cyberattack.

Cyber resilience efforts must cover all of these areas and continuously *test* that the measures effectively protect critical IT systems. System owners must test both the ability to protect against and mitigate an attack and the ability to safely restore normal operations after an attack and, as far as possible, continue the most critical parts of operations until recovery is complete.

Protecting against cyberattacks should be a key part of an organisation's strategy and should be a major focus for management.

Danmarks Nationalbank's oversight shows that the owners of the core systems and solutions in the payments infrastructure generally demonstrate a high level of maturity in their work with cyber resilience and are well equipped to prevent and protect against cyberattacks. However, despite ongoing efforts in cybersecurity, it is not possible to fully protect oneself against cyberattacks. It is therefore essential that system owners continue to develop contingency plans to deal with the consequences of potential attacks that could not be prevented.

Danmarks Nationalbank's oversight continuously focuses on system owners' efforts to strengthen and adapt their cyber resilience to the evolving threat landscape. In this context, Danmarks Nationalbank recommends that system owners prepare for extreme but plausible cyber scenarios. This includes being able to restore operations quickly and safely – even after an extreme situation, such as one involving widespread damage to critical data.⁴

In 2024, Danmarks Nationalbank also monitored the system owners' efforts to comply with the DORA regulation and the NIS2 directive⁵, which, among other things, will help to strengthen supplier management and the crisis management functions that will handle specific cyberattacks.

Danmarks Nationalbank's oversight activities also include discussions with system owners on the consequences of the geopolitical situation, including the series of incidents involving damage to submarine communication cables in the Baltic Sea and elsewhere. Danmarks Nationalbank has emphasised that system owners must ensure that there is sufficient redundancy in the critical cable connections used by the systems, and Danmarks Nationalbank continuously monitors the system owners' work in this area.

⁴ Danmarks Nationalbank has prepared assessments according to the international cyber resilience guidelines for ES-CPH in 2020, retail payment systems in 2022, and for Dankort and Danmarks Nationalbank's collateralisation system, Calypso, in 2024.

⁵ Directive (EU) 2022/2555 of the European Parliament and of the Council of 14 December 2022 on measures to ensure a high common level of cyber security across the Union, amending Regulation (EU) no. 910/2014 and Directive (EU) 2018/1972 and repealing Directive (EU) 2016/1148. The Directive on Security of Network and Information Systems (NIS2) will apply from 18 October 2024.

Collaborations across the sector provides important contributions to strengthening cyber resilience

The systems in the financial infrastructure are closely interconnected and it is important that system owners coordinate cyber resilience efforts and share experiences in this area. That is why system owners, along with other parts of the financial sector, participate in a number of sector collaborations.

The Financial Sector Forum for Operational Resilience, FSOR, is a public-private partnership aimed at increasing the sector's operational resilience, including resilience to cyberattacks.⁶ The owners of the central systems and solutions in the infrastructure participate in FSOR and use the collaboration to support their own cyber resilience work. This is done by discussing risks, sharing knowledge, participating in tests coordinated by the FSOR's Crisis Management⁷ and implementing joint mitigation initiatives.

*The Risk Forum for Interdependencies, RGA*⁸, is a collaborative forum between those responsible for the central systems in the infrastructure, whose purpose is to identify and address operational risks that cut across systems. In 2024, the RGA has focused on adapting its work to the new system landscapes after the transition to settlement of payments in Danish kroner on TARGET Services in Easter 2025, see box 2. In 2023, the RGA finalised work on joint plans for controlled shutdown and reopening in a number of scenarios. Danmarks Nationalbank expects system owners to continue their own work on plans for controlled shutdown and testing in 2025. By participating in the RGA, system owners follow the recommendations of international standards regarding managing risks from interdependencies.

The core infrastructure systems and solutions are also all part of *Nordic Financial CERT, NFCERT*⁹, a joint Nordic sectoral collaboration on the collection and sharing of information on cyber threats and cyberattacks. Participation in NFCERT ensures compliance with international standards for participating in this type of cross-sectoral information sharing.

Finally, the owners of systems and solutions in the infrastructure all participate in Danmarks Nationalbank's TIBER¹⁰-DK programme. Since 2019, Danmarks Nationalbank has facilitated and coordinated the implementation of threat-based tests through the TIBER-DK programme, simulating advanced cyberattacks in actual production environments. TIBER-DK participants also share learnings from these tests with each other to further strengthen cyber resilience.

⁶ Danmarks Nationalbank acts as chair and secretariat for FSOR, which in addition to those in charge of the systems and solutions in the infrastructure includes banks, the banks' shared IT operators, pension and insurance companies, relevant authorities and Nordic Financial CERT. See the FSOR's 2024 Annual Report ([link](#)).

⁷ The FSOR's Crisis Management was established to coordinate the response across the financial sector in the event of a crisis that could threaten financial stability. The FSOR's Crisis Management supplements the members' own crisis management plans as well as the national crisis response, NOST.

⁸ The Risk Forum for Interdependencies is a cooperation forum between the organisations responsible for the central payment and settlement systems in the infrastructure, i.e. Danmarks Nationalbank (interbank payments), ES-CPH (securities transactions), Finance Denmark (retail payments) and e-nettet (communication network). The work of the RGA is coordinated with the FSOR.

⁹ Nordic Financial CERT, NFCERT, is a member-driven non-profit organisation, and its objective is to strengthen the Nordic financial industry's resilience to cyberattacks and enable Nordic financial institutions to respond quickly and effectively to cyber security threats and online crime. NFCERT collects and shares information about cyber threats and cyberattacks. Threat Intelligence-based Ethical Red Teaming.

Internationalisation of infrastructure continues

Over the years, the Danish payments infrastructure has become more closely integrated into the European payments infrastructure, and several of the owners of Danish systems and solutions have been integrated into international groups. This trend has continued in 2024 and early 2025.

As described above, the settlement of payments in Danish kroner has been transferred from Danmarks Nationalbank's settlement system, Kronos2, to the pan-European system TARGET Services, see box 2.

In 2024, Finance Denmark signed a Memorandum of Understanding with EBA CLEARING, which clears retail payments in euros, to develop a new clearing solution in Danish kroner. The solution will replace the existing Intradagclearing.¹¹ This is described in more detail in chapter 4, *Clearing and settlement of retail payments*.

ES-CPH has continued to integrate its systems into the Euronext Group and in 2024, ES-CPH started using the Euronext Group's platform for handling corporate actions, i.e. periodic payments, issues, redemptions, etc. The goal is that the four central securities depositories in the Euronext group¹² will eventually all use the same technical platform for handling securities. In 2024, ES-CPH also continued its work on phasing out the local settlement platform, the ES-CPH settlement, ensuring that from September 2027, all settlement of securities transactions in Danish kroner will take place on the pan-European platform T2S. This is described in more detail in chapter 5, *Securities settlement*.

Finally, in 2024, Nets, which operates Dankort, and MPS, which operates Betalingsservice, continued their integration into the international groups they are part of. This has included efforts related to risk management and contingency planning. This is described in more detail in chapter 3, *Retail payments*.

¹¹ For more information, see chapter 4, *Clearing and settlement of retail payments*.

¹² In addition to ES-CPH, the central securities depositories in Italy, Norway and Portugal are part of the Euronext Group.

02

Interbank payments and the central settlement of payments in Danish kroner

An interbank payment is a payment between financial institutions. These payments are typically time-critical and high-value.

In 2024 and until 16 April 2025, interbank payments in Danish kroner were settled in Danmarks Nationalbank's payment system, Kronos2. The centralised settlement of krone payments now takes place in TARGET DKK, see box 2. TARGET DKK consists of the ECB's T2, T2S and TIPS (TARGET Services) systems and Danmarks Nationalbank's own system for collateral and monetary policy instruments, SPI.

Kronos2, like TARGET DKK, was an RTGS system. RTGS stands for real-time gross settlement, which means that payments are settled individually and instantly.

Danmarks Nationalbank's RTGS system is the backbone of the Danish payments infrastructure, see box 2. In addition to interbank payments, monetary policy operations and net positions from the retail payment systems, among others, are also settled and liquidity is transferred to settle securities and foreign exchange trades that take place in other systems.

So far, participation in Danmarks Nationalbank's settlement system has mainly been limited to banks. Due to changes in EU legislation, payment institutions and electronic money institutions have, since April 2025, been able to apply for participation in the central payment systems, including TARGET DKK.¹³

The following sections describe the use and operation of Kronos2. The section on international standards and the work on cyber resilience covers Kronos2, but the work is also relevant to Danmarks Nationalbank's system landscape after the transition to TARGET DKK.

Use

Most Danish banks and mortgage credit institutions hold accounts with Danmarks Nationalbank in the same way private individuals hold accounts with commercial banks. Furthermore, branches of foreign banks also participate. At the end of 2024, there were 70 participants in the settlement in Kronos2.

¹³ In April 2025, amendments to the so-called Finality Directive entered into force (Regulation (EU) 2024/886 of the European Parliament and of the Council of 13 March 2024 amending Regulations (EU) No. 260/2012 and (EU) 2021/1230 and Directives 98/26/EC and (EU) 2015/2366 as regards instant credit transfers in euro). The changes allow payment institutions (non-bank payment service providers) and electronic money institutions to participate directly in the settlement of payments in the central payment systems, including TARGET DKK, without having to go through a bank. However, payment institutions will only have access to settlement accounts at Danmarks Nationalbank and will not be able to use monetary policy instruments.

In 2024, interbank payments in Kronos2 totalled kr. 100.9 billion on average per banking day. This is an increase of 5.4 per cent from 2023, see table 1.

TABLE 1

Transactions in Kronos2, average per banking day

Kr. billion, current prices	2020	2021	2022	2023	2024
Interbank payments	87.6	88.7	101.5	95.8	100.9
- Of which customer payments	14.0	16.6	20.7	19.8	21.5
Monetary policy operations	34.4	6.0	0.3	0.01	0.0
- Of which sales of certificates of deposit	33.2	5.5	0.5	0.01	0.0
- Of which monetary policy lending	1.3	0.5	0.3	0.0	0.0
Reservation of liquidity for settlements	113.9	106.2	97.9	75.8	68.4
- Of which to Sumclearing, Intradagclearing and Straksclearing	39.9	40.6	40.1	32.9	32.9
- Of which to ES-CPH settlement	41.2	38.3	35.2	21.2	13.5
- Of which to CLS	32.8	27.2	22.5	21.7	22.0
Net positions settled	16.6	17.0	17.9	17.9	18.1
- Of which in Sumclearing, Intradagclearing and Straksclearing	8.3	9.3	10.0	9.8	10.2
- Of which in ES-CPH settlement	0.9	0.8	0.2	0.01	0.002
- Of which in CLS	7.3	6.8	7.7	8.1	7.9
Transfers to T2S (reservation of liquidity for settlements) *	22.2	22.2	18.6	18.0	29.4

* Participants' transfers from Kronos2 to T2S are made to reserve liquidity in accounts on T2S for the settlement of securities trading.

This corresponds to the reservation of liquidity that takes place on accounts in Kronos2 to execute settlements of retail payments, securities trading and foreign exchange trading.

Once the settlements of securities transactions on T2S have been completed, the money is transferred back from T2S to the participants' accounts in Kronos2 every day.

Source: Danmarks Nationalbank.

Operational reliability

The operational stability of Kronos2 has been satisfactory in 2024.

A single incident in Kronos2 in October meant that participants temporarily lost access to the system. The business impact of the outages was limited, but led to a delay of approximately 15 minutes in the first nightly clearing of retail payments. There was also a risk that the incident could have delayed settlement of foreign exchange transactions in CLS. The October incident was caused by a system error in a technical support tool, which was subsequently uninstalled.

In 2024, there have been several incidents in other payment and settlement systems that have affected Kronos2 due to the interdependence of the payments infrastructure:

In January 2024, T2S experienced delays that affected the settlement of Danish kroner and led to a postponement of the closing of the monetary policy day. The cause of the incident on T2S was a system update that contained a bug causing a message on T2S to block the execution of other messages in T2S. The relevant part of the system update was subsequently rolled back.

At the end of third quarter 2024, Kronos2 was affected by issues at ES-CPH. The incident in ES-CPH led to the closing of the monetary policy day in Kronos2 being postponed because the settlement in T2S with Danish kroner was delayed. The incident was initially caused by an error in ES-CPH's corporate actions system, see chapter 5 on *Securities settlement*.

In February 2025, a major incident in TARGET Services rendered T2 and T2S inaccessible for several hours. This resulted in a postponement of the closing of the monetary policy day in Kronos2 from 16:45 to 23:45, as the day could not be closed until liquidity was returned from T2S to Kronos2. For a more detailed description of the event see chapter 6, *Payments and securities settlement in euro*.

Liquidity

Participants continued to have ample liquidity in 2024 to execute payments in Kronos2 – both interbank payments and payments resulting from settlement instructions from the connected payment and settlement systems (the retail payment systems, ES-CPH and CLS), see chart 1.

Since the commissioning of Kronos2 in 2018, Danmarks Nationalbank has conducted regular liquidity stress tests in accordance with the requirements of the CPMI-IOSCO Principles for Financial Market Infrastructures, PFMI.

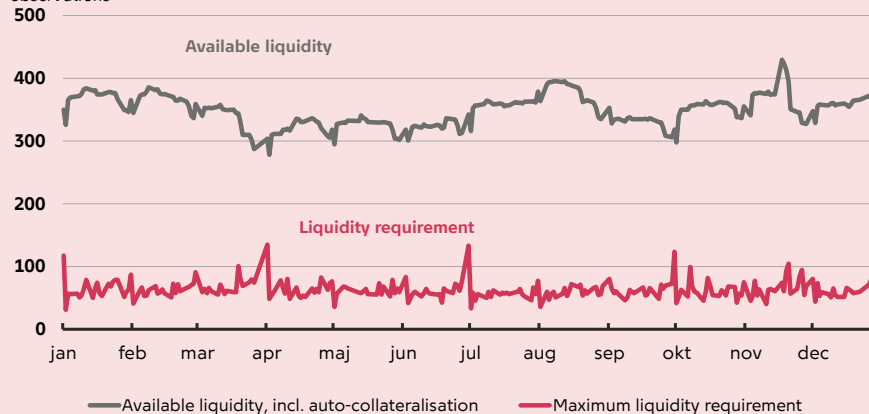
The liquidity stress test from 2024 showed that payment settlement generally appears robust.¹⁴ The stress test found a few days with larger liquidity effects in scenarios where the largest participants in the system cannot send payments. However, the stress test also showed that the existing contingency procedures are effective in reducing the negative liquidity effects of an operational disruption of 1-2 days. In addition, the stress test showed that TARGET DKK's built-in queuing functionality increases robustness. This means that payments are not rejected by the system when there is a lack of liquidity, but are settled when liquidity is available again.

¹⁴ See nationalbanken.dk for a detailed description of the results of the liquidity stress test ([link](#)).

CHART 1

Available liquidity versus liquidity needs of Kronos2 participants in 2024

Billion. kr., daily observations



Note: The participants' disposable liquidity consists of deposits in their main accounts with Danmarks Nationalbank as well as their opportunity to borrow funds on an intraday basis against collateral.

Source: Danmarks Nationalbank.

Cyber resilience

Danmarks Nationalbank works continuously to strengthen the cyber resilience of its systems and business processes. An important part of this work is to ensure that Danmarks Nationalbank complies with SWIFT's Customer Security Programme, CSP, a set of mandatory security controls designed to strengthen resilience in case of cyberattacks. In 2024, the work on compliance with SWIFT's CSP has included both Kronos2 and Danmarks Nationalbank's new platform, which supports the settlement of kroner on TARGET DKK.

In 2024, Danmarks Nationalbank started using a new testing method aimed at improving defence against cyberattacks. The test is called a purple teaming test because the test is carried out in collaboration between the blue team – the employees who work with the critical systems on a daily basis and look out for suspicious behaviour – and the red team, employees from an external company who try to compromise the systems by simulating attacks that mimic realistic cyberattacks. In the test, blue teams are trained to detect and stop malicious actors that have penetrated the systems. The red team tests the security measures in close dialogue with the blue team, and during the test, learning is shared – including identified weaknesses or areas with potential for improvement – that need to be addressed to strengthen the systems against actual attacks. Any repairs are made and retested as far as possible within the test period. The purple teaming test will be used continuously and is a supplement to Danmarks Nationalbank's participation in the TIBER-DK test programme.

In the ongoing work with risk management, there has been intense focus on strengthening contingency plans. The work has included a review of Danmarks Nationalbank's crisis management functions and obligations in order to ensure the necessary crisis management capacity for critical incidents. In addition, a test

of the FSOR's Crisis Management was held in June, where the incident scenario meant that both the sector's joint response and Danmarks Nationalbank's internal crisis response were activated simultaneously. The review of the crisis management plan and the completed test addressed an outstanding improvement potential identified in the assessment of Kronos2's compliance with PFMI¹⁵ in 2021.

International standards

In 2024, Danmarks Nationalbank's oversight has finalised an assessment of Calypso against the CPMI-IOSCO's Cyber Guidance¹⁶. Calypso is Danmarks Nationalbank's system for collateral and monetary policy instruments, SPI. The system is important for settlement in Danish kroner and is used by participants to pledge collateral in the form of securities in exchange for credit that they can use to settle payments. The CPMI-IOSCO Cyber Guidance describes the measures that systemically important payments infrastructure should have in place to strengthen its resilience to the risks posed by the cyber threat landscape.

The assessment highlighted a few areas for improvement. Among other things, Danmarks Nationalbank must strengthen its work on crisis management for cyber incidents, including the ability to handle extreme but plausible scenarios.

Danmarks Nationalbank's oversight has assessed the bank's compliance with CPMI's endpoint security strategy. The strategy aims to reduce the risk of criminal transactions in central payment systems by focusing on endpoint security¹⁷. As a follow-up to the assessment, a timeline has been established for when Danmarks Nationalbank expects to address the outstanding items.

To fully comply with the strategy, an annual process must be established in which Danmarks Nationalbank, together with the participants, analyses risks related to endpoints and reviews protective controls to better understand and mitigate risks in the ecosystem surrounding Danmarks Nationalbank's RTGS system. In addition, the joint response must be tested against a fraud scenario. Parts of the strategy have been implemented in connection with the migration of the Danish krone settlement to TARGET Services. In accordance with the strategy, TARGET Services requires that all participants must have general security controls in place to prevent fraud or attempted fraud, among other things. Participants must also document annually that these security controls and measures (endpoint security) are in place and effective.

¹⁵ See Danmarks Nationalbank, Assessment of Kronos2, *Danmarks Nationalbank Report*, no. 4, December 2021 ([link](#)).

¹⁶ CPMI-IOSCO Guidance on cyber resilience for financial market infrastructures.

¹⁷ An *endpoint* is defined in the strategy as a point at which information about payment instructions is exchanged between two parties in the ecosystem, e.g. between a payment system and a participant.

03

Retail payments

When citizens and businesses in Denmark buy goods and pay bills, they most often use Dankort, international payment cards from Visa and Mastercard, MobilePay, Betalingsservice and account-to-account transfers via online banking or mobile banking. In 2024, these and other digital payment solutions were used to make payments totalling kr. 33.4 billion on average per day.

Danmarks Nationalbank conducts oversight of Dankort and Betalingsservice. Credit transfers are overseen as part of Danmarks Nationalbank's oversight of the retail payment systems. Visa and Mastercard are overseen by the Eurosystem. The oversight is based on the PISA standards, see box 4. Danmarks Nationalbank regularly considers whether targeted oversight of other payment solutions is needed if they have become more important in the Danish market.

BOX 4

Payment solutions are overseen according to PISA standards

Danmarks Nationalbank bases its oversight of payment solutions on the ECB's payment solutions standards¹, PISA, published in 2022.

PISA maintains the core elements of the ECB's previous standards for payment solutions, but in some areas PISA is more explicit in its requirements, particularly in relation to risk management, cybersecurity and contingency planning. PISA is based on PFMI but with adaptations to ensure that the standards are relevant for payment solutions.

¹ See ECB's standards for payment solutions, *Eurosystem oversight framework for electronic payment instruments, schemes and arrangements*, PISA ([link](#)).

Dankort

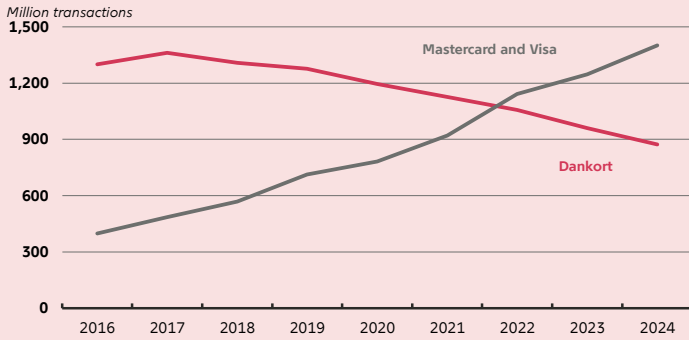
Danmarks Nationalbank's oversight of Dankort is aimed at Nets, which is the system owner of Dankort.

Since 2017, there has been a significant decrease in Dankort usage. The decrease in Dankort usage is mainly due to increased use of Visa and Mastercard, see charts 2 and 3. However, Dankort still plays a central role in Danish retail payments.

CHART 2

Dankort and international card usage in Denmark (volume)

Total volume of transactions made with payment cards in Denmark

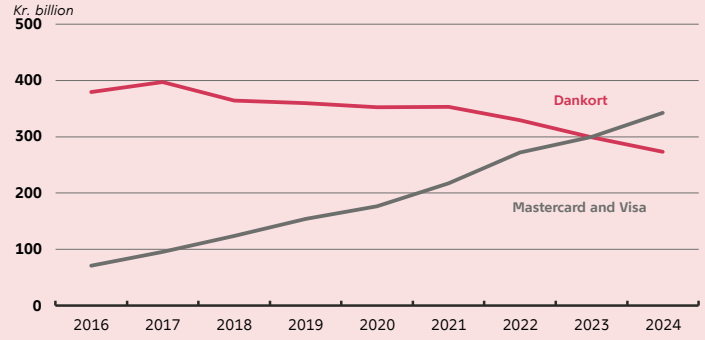


Note: The calculation covers card payments in physical trade, online and self-service environments in Denmark.
Source: Nets and Danmarks Nationalbank.

CHART 3

Dankort and international card usage in Denmark (value)

Total value paid with payment cards in Denmark



Note: The calculation covers card payments in physical trade, online and self-service environments in Denmark.
Source: Nets and Danmarks Nationalbank.

The development in card usage is partly driven by the increased use of international cards in mobile payments via Apple Pay and Google Pay, which were introduced in Denmark in October 2017 and 2018 respectively.¹⁸

Until the end of 2024, only Danske Bank and most recently Nordea¹⁹ offered their customers the option to pay with Dankort in Apple Pay. As of March 2025, banks affiliated with the shared IT operators BEC and SDC, including Nykredit Bank, Spar Nord, Arbejdernes Landsbank, Sparekassen Danmark, Sparekassen Kronjylland and Lån & Spar Bank, have offered their customers the option to pay with Dankort in Apple Pay.²⁰ From the beginning of 2025, Nets has required that when a card issuer/bank enables the use of a card co-branded with Dankort in a wallet solution, the Dankort function must also be supported. If a bank issues a co-branded Visa/Dankort card where the Visa function can be used in Apple Pay, the bank must also ensure that the Dankort function is available in Apple Pay. Nets expects this to strengthen Dankort's position in the market in the long term.

Operational stability

Dankort operations were satisfactory in 2024, with high operational stability and only a few minor incidents. The incidents have not given rise to further follow-up from Danmarks Nationalbank.

In 2024, Nets implemented a technical solution that distributes the processing of card transactions more evenly throughout the day to avoid delays in submissions for settlement and accounting. The solution also entails that any delays in processing Dankort payments cannot affect payments with international cards and vice versa. The solution has been implemented as a follow-up to issues in 2023 where delayed transmission of Dankort transactions

¹⁸ See nationalbanken.dk, *The digital retail payment market is changing, 2025 (link)*.
¹⁹ Nordea customers could use Dankort in Apple Pay from November 2024.
²⁰ See FinansWatch, *40 banker åbner for Dankort i Apple Pay, 25 March 2025 (link)*.

in some cases meant that shops received payments for sales a day later than usual. Danmarks Nationalbank has followed Nets' work to implement the solution.

Fraud

Dankort fraud remains low. It totalled kr. 29.4 million in 2024, corresponding to 0.10 per mille of total Dankort payments.

Although Dankort fraud is low, there has been a considerable increase in fraud in recent years. From 2023 to 2024, fraud increased by 21 per cent.²¹ This reflects an increase in both theft and lost cards, as well as online shopping fraud.

Fraud related to card theft or loss continues to make up the majority of fraud. This type of fraud amounted to kr. 22.1 million in 2024, while online shopping fraud totalled kr. 7.3 million.

The use of strong customer authentication has reduced online fraud involving stolen or copied cards. According to Nets, online shopping fraud is now primarily done by manipulating cardholders into making fraudulent payments.

According to Nets, fraud is increasingly occurring in physical trade and at ATMs, where the cardholder is tricked into giving up their card and PIN code, for example, by fraudsters pretending to be from the police.

International standards

In 2024, Danmarks Nationalbank continued its dialogue with Nets about Dankort's compliance with PISA. In this regard, Danmarks Nationalbank has assessed Dankort according to PISA's requirements for risk management and contingency planning and made recommendations for Nets' work in these areas. Among other things, Danmarks Nationalbank has recommended that Nets strengthen its cyber contingency planning and ability to handle extreme but plausible scenarios. In 2025, Danmarks Nationalbank will follow up on Nets' work with the recommendations.

In 2024, Danmarks Nationalbank also monitored Nets' work to ensure compliance with the DORA regulation, which will apply from January 2025. This has included updates to Nets' framework for risk management and contingency planning. As part of this process, Nets has also worked further on the integration of Dankort into the European payment group Nexi Group, which Nets became part of in early 2022.

Betalingservice

Danmarks Nationalbank's oversight of Betalingservice is aimed at Mastercard Payment Services Denmark A/S, MPS, which is the system owner of Betalingservice.

In 2024, Danmarks Nationalbank agreed with MPS that the oversight of Betalingservice will be expanded to include the PBS clearing, which is used to

²¹ As a share of total transactions. The increase in Danish kroner is smaller due to the decrease in Dankort usage.

collect transactions from Betalingsservice and card payments before they are sent to the Sumclearing.²²

In 2021, MPS acquired Betalingsservice and the PBS clearing from Nets. In this regard, MPS entered into an agreement with Nets that Nets would contribute to supporting the operation of the two systems for a transitional period. MPS has gradually taken over more parts of the operation of Betalingsservice and the PBS clearing, and the majority of the operation was taken over in 2023 in connection with the migration of the underlying systems from Nets' production environment to MPS' own production environment in Kyndryl's data centre. The transition agreement expired in March 2025, and MPS now handles the full operation of Betalingsservice and the PBS clearing. Danmarks Nationalbank believes that the transition has been carried out appropriately and has ensured the necessary continuity in operations.

Operational stability and fraud

As in previous years, the operational stability of Betalingsservice in 2024 was high with no system breakdowns or other significant incidents. There was no fraud in Betalingsservice in 2024.

There was an incident in the PBS clearing in November 2024 where errors in accounting files caused problems with some banks' reconciliation of customers' accounts. Danmarks Nationalbank has discussed the follow-up of the incident with MPS.

International standards

In 2024, Danmarks Nationalbank continued its dialogue with MPS regarding the plans for Betalingsservice's compliance with PISA, and MPS has worked throughout the year to implement the plan. As part of this, MPS has been working to strengthen its contingency planning to be able to handle extreme but plausible scenarios. The work with PISA compliance involves measures in both the first and second line of defence with quarterly follow-up on PISA compliance and reporting to the Committee of Directors. Danmarks Nationalbank will discuss the results of this work with MPS in 2025.

In 2024, Danmarks Nationalbank followed MPS' work on implementing the requirements of the DORA regulation, especially with regard to risk management and contingency planning. This work has also involved further integrating MPS into the Mastercard Group's efforts in these areas. In this regard, Danmarks Nationalbank has discussed with MPS how this work can help fulfil the requirements of PISA.

²² For Sumclearing and the other retail payment systems, see chapter 4, *Clearing and settlement of retail payments*.

04

Clearing and settlement of retail payments

In 2024, Danish retail payments were cleared and settled in the Sumclearing, Intradagclearing and Straksclearing, also known as the retail payment systems. The retail payment systems are owned by Finance Denmark, managed by e-nettet and provided by Mastercard Payment Services A/S, MPS.

In Sumclearing, payments made with payment cards, inpayment forms and Betalingsservice are settled once a day on banking days. In Intradagclearing, account-to-account transfers such as online banking transfers, salary payments and government payments are settled five times a day on banking days. The banks' net positions – corresponding to the sum of payments to and from their customers – are calculated in the systems at fixed times. The net positions are sent to Danmarks Nationalbank's RTGS system – in 2024, Kronos2 – where the amounts are exchanged between banks. The payments are then posted to the customers' accounts at the banks.

In 2024, Straksclearing enabled account-to-account transfers in seconds, 24 hours a day, 7 days a week. This was possible because the banks reserved liquidity in advance in Kronos2 for the transfers. The actual interbank exchange of liquidity took place six times a day on banking days. The Straksclearing system was used primarily for online banking transfers and payments via MobilePay.

The retail payment infrastructure has undergone a number of changes in connection with Danmarks Nationalbank's decommissioning of Kronos2 and moving to TARGET DKK, see box 2. In Easter 2025, the Sumclearing and Intradagclearing was integrated with T2 via TARGET DKK. At the same time, Straksclearing was decommissioned. Instead, instant payments in Danish kroner are now settled in TIPS through TARGET DKK.

So far, participation in the retail payment systems have mainly been limited to banks. Due to changes in EU legislation, payment institutions and electronic money institutions have been able to apply to participate in the centralised payment systems, including the retail payment systems, since April 2025.²³

Use

At the end of 2024, there were 45 direct participants in the retail payment system and 22 indirect participants, which settle through a direct participant.

The value of transactions in the systems averaged kr. 48.6 billion per banking day in 2024, see table 2. This is an increase of 3.2 per cent compared to 2023.

²³ In April 2025, amendments to the so-called Finality Directive entered into force (Regulation (EU) 2024/886 of the European Parliament and of the Council of 13 March 2024 amending Regulation (EU) No 260/2012 and (EU) 2021/1230 and Directive 98/26/EC and (EU) 2015/2366 as regards instant credit transfers in euro). The changes allow payment institutions (non-bank payment service providers) and electronic money institutions to participate directly in the settlement of payments in the centralised payment systems, including the retail payment system, without having to go through a bank.

TABLE 2

Value of transactions in the Sumclearing, Intradagclearing and Straksclearing, 2020-2024, average per banking day

Kr. billion, current prices	2020	2021	2022	2023	2024
Sumclearing	18.7	20.5	21.3	21.2	21.8
Intradagclearing	21.9	23.9	25	24	24.9
Straksclearing	1.6	1.7	1.8	1.9	1.9
Total	42.2	46.1	48.1	47.1	48.6

Source: Mastercard Payment Services A/S, MPS.

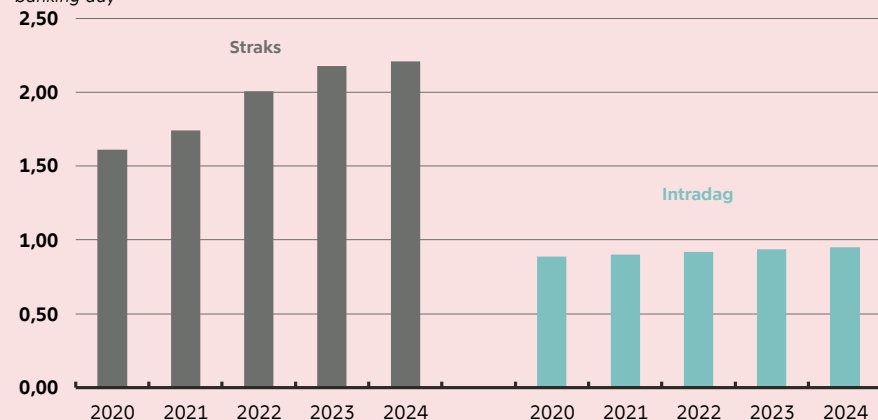
The number of transactions in Straksclearing has increased since the years during the covid-19 pandemic, see chart 4.

CHART 4

Number of transactions in Straksclearing and Intradagclearing, 2020-2024

Total number of transactions cleared and settled in Straksclearing and Intradagclearing

Million,
Average per
banking day



Source: Mastercard Payment Services A/S, MPS.

Operational reliability

In 2024, the retail payment systems had high operational stability with a few incidents of minor importance. The incidents have not given rise to further follow-up from Danmarks Nationalbank.

Liquidity

The banks reserve liquidity on accounts at Danmarks Nationalbank for settlement of their net positions in Sumclearing and Intradagclearing. If a participant does

not reserve sufficient liquidity, its settlement will be postponed, and new net positions will be calculated for the other participants, who thereby risk not receiving the expected liquidity

There were no suspensions due to lack of liquidity in 2024.

International standards and cyber resilience

Finance Denmark is continuously working to strengthen the cyber resilience of the clearing systems and in 2024 continued its efforts to implement Danmarks Nationalbank's recommendations from the 2022 assessment based on the CPMI-IOSCO Cyber Guidance. Among other things, Finance Denmark has strengthened the requirements in its contract with the supplier Mastercard Payment Services, MPS. This has, among other things, enabled a review of MPS' compliance with the ECB's Cyber Resilience Oversight Expectations for Financial Market Infrastructures, CROE. The review showed that MPS highly complies with the expectations of CROE. In few areas, there is a plan for further improvements. In addition, Finance Denmark has strengthened the management of legacy/end-of-life assets and analysed the need for additional encryption.

Finance Denmark continues its work to strengthen cyber resilience in the clearing systems. This includes strengthening the ability to restore and/or maintain operations within set timeframes after liquidity, technical and cyber-related incidents, including extreme but plausible scenarios.

Another element in the work with cyber resilience is Finance Denmark's Cyber Security Handbook for the clearing systems. The handbook sets requirements for the IT security of the banks' shared IT operators and the participating banks, which must evaluate and report their compliance with these requirements annually. As usual, Finance Denmark followed up on the annual evaluation in 2024 in accordance with the requirements of the cybersecurity handbook.

In third quarter 2024, Finance Denmark updated the Cybersecurity Handbook to include requirements for participants and the banks' shared IT operators to work more actively with their resilience and recovery capabilities, including contingency planning and emergency procedures. The aim is to ensure that the sector maintains a continuous focus on these areas. The implementation period for the changes runs until the end of 2025.

Focus on reducing fraud

In December 2023, Finance Denmark set up a fraud task force to address fraud targeting private individuals. The aim was to identify criminals' processes, methods and systems and make recommendations for improvements to reduce digital fraud.²⁴ The task force finalised its work in 2024 and presented 18 specific recommendations²⁵. Some recommendations have already been implemented or are in the process of being implemented, while others depend on changes in legislation either nationally or in the EU.

Particularly relevant for clearing participants is a recommendation to establish a freezing mechanism. Such a system should be able to freeze fraudulent transactions so that fraudsters cannot move fraudulent funds from their

²⁴ See also Finance Denmark, *Kampen mod digital svindel*, December 2023 ([link](#)), and Finance Denmark, *Netbanksvindel, 2023* ([link](#)).

²⁵ See Finance Denmark, *Her er 18 anbefalinger, der kan bremse it-svindlen i Danmark*, November 2024 ([link](#)).

accounts. Finance Denmark is exploring the possibility of establishing a common solution for the Danish financial sector. Implementing the recommendation requires, among other things, a change in legislation.²⁶

Finance Denmark also plans to establish a Verification of Payee service, VoP, for the banks. VoP, like the freezing scheme, is a tool designed to combat fraud and abuse. Upcoming EU legislation²⁷ includes a requirement that payment service providers must offer a service that ensures verification of the payee to whom the payer wants to make a standard credit or instant credit payment.

System changes in the clearing infrastructure in 2024

In 2024, MPS completed the work of relocating the operation of the clearing systems from Nets' production environments to its own environments.²⁸ In close coordination with Finance Denmark, the move was divided into several migration phases. In May 2024, the Sumclearing operation was moved from Nets' production environment at Kyndryl to MPS' production environment at Kyndryl. In September 2024, the Intradagclearing and Straksclearing operations were moved from Nets' data centres in Norway to new MPS data centres in Norway and Sweden respectively. With the data centre move, all clearing operations now run in MPS's own environments, independent of Nets.

Sector programme for the modernisation of the retail payment infrastructure

Under the auspices of Finance Denmark, an overall sector plan has been drawn to ensure the continued modernisation of the Danish retail payment infrastructure. The work is anchored in a sector programme under Finance Denmark's Committee of Directors, where a steering committee with broad sector representation has been established. The programme is run by e-nettet in close collaboration with Finance Denmark and coordinated with Danmarks Nationalbank as system owner of TARGET DKK.

Under the sector programme, Finance Denmark has prepared a long-term strategic plan for the Danish retail payment infrastructure, where one of the objectives is to establish a new batch clearing. This is partly driven by a sector decision to use the payment standards managed by the Nordic Payments Council, NPC²⁹. This means that the clearing systems must be able to send and receive NPC-compliant message formats for account-to-account transfers. Sumclearing and Intradagclearing currently use older message formats and are therefore not NPC-compatible.

Finance Denmark has signed a memorandum of understanding with EBA CLEARING on a new STEP2 DKK clearing solution to replace the existing Intradagclearing. With the new STEP2 DKK clearing, batch clearing will be elevated to a standard platform that is NPC-compatible. Furthermore, Finance

²⁶ See European Commission, Revision of the Second Payment Services Directive, PSD3, and a new Payment Services Regulation, PSR ([link](#)).

²⁷ See ECB on EU legislation for standard credit and instant credit transfers, Instant Payment Regulation, IPR ([link](#)).

²⁸ In 2021, MPS acquired the areas of Nets' infrastructure that include the operation of the retail payment systems and since 2022 has worked on moving the operation of the clearings to its own infrastructure. See also Mastercard Payment Services Denmark A/S, "Mastercard completes acquisition of Nets account-to-account payment business", March 2021 ([link](#)).

²⁹ NPC was established in 2018 as an independent non-profit organisation by the four Nordic banking associations (Bits A/S (Norway), Finance Denmark (Denmark), Finassiala (Finland) and Svenska Bankföreningen (Sweden)). The NPC's main purpose is to harmonise payment standards in the Nordic region, and work continues across the Nordic banks. NPC's payment standards are based on the European Payment Council's, EPC, rulebooks and guides, with some adaptations to Swedish legislation and the context of local payment landscapes in the Nordic region.

Denmark expects the STEP2 DKK clearing to increase the resilience level. Finance Denmark expects the new clearing to be launched in late 2026 or early 2027.

Development of an instant payment system across currencies

In January 2024, Danmarks Nationalbank signed an agreement with the ECB and the Swedish central bank, Sveriges Riksbank, to participate in a project called TIPS cross-currency. The project will enable a citizen or business to make a payment in, for example, Danish kroner, which the payee can then immediately receive in euros or Swedish kronor. The system is designed to make international payments faster and cheaper. Eventually, the system can be expanded to handle other EU currencies if they become part of TIPS, or potentially connected to instant payment systems outside the EU.

05 Securities settlement

Securities transactions can be concluded in different ways: on the stock exchange, through a multilateral trading facility or bilaterally between the parties through a bank or a stockbroker. After the trades have been concluded, there must be final settlement, i.e. where money and securities are exchanged between the participants.

The central securities depository Euronext Securities Copenhagen, ES-CPH³⁰, handles the settlement of trades in Danish-issued securities, and registrations of changes in the holdings of securities are made in the participants' accounts in ES-CPH.

Securities transactions between banks and other financial institutions are initially settled on accounts in the pan-European system TARGET2-Securities, T2S, which handles the settlement process on behalf of ES-CPH. Movements of securities in accounts on T2S are subsequently mirrored in accounts in ES-CPH's systems. In legal terms, the final settlement of the securities trades has only taken place when the relevant securities accounts in ES-CPH are updated. The settlement of the money side also takes place on accounts on T2S. Participants must therefore transfer liquidity to their settlement accounts in Danish kroner on T2S.³¹ Trades between banks and their own customers continue to be settled in ES-CPH's own settlement system, ES-CPH settlement.³² In recent years, ES-CPH has gradually reduced the use of the ES-CPH settlement and will phase it out completely during 2027.³³

ES-CPH is also responsible for handling periodic payments, issues, redemptions, etc.³⁴ ES-CPH is the only company in Denmark authorised by the Danish Financial Supervisory Authority as a central securities depository.

Use

ES-CPH has 89 participants, of which 38 are foreign market participants, including four Central Counterparties, CCPs³⁵. In 2024, 46 ES-CPH participants also had an account in Kronos2 in order to transfer liquidity to their T2S settlement account. It was also possible to transfer liquidity to T2S DCAs via a Kronos2 participant without being a Kronos2 participant. After Easter 2025, this transfer of liquidity will take place in the same way, but from accounts in TARGET DKK instead of Kronos2, see chapter 2, *Interbank payments*.

³⁰ Until November 2020, ES-CPH was called VP Securities. VP Securities was then acquired by the pan-European stock exchange and the market infrastructure group Euronext Group. The change of name is only commercial, and the Danish company is still registered as VP Securities A/S in the CVR register.

³¹ Until Easter 2025, liquidity could be transferred from Danmarks Nationalbank's payment system Kronos2. After the migration of Danish kroner from Kronos2 to T2 (see chapter 2 on interbank payments) in Easter 2025, transfers take place from T2 to T2S. However, a large part of the liquidity requirement is handled by participants pledging collateral in their securities.

³² The division of settlement between T2S and ES-CPH settlement is also known as the layered settlement model.

³³ You can also read more about this development in the section on System changes below.

³⁴ Also known as corporate actions.

³⁵ The four foreign CCPs in ES-CPH are Cboe Clear Europe N.V., LCH Clearnet and Six x-clear, which clear equity trades, while Nasdaq Clearing AB clears repo trades. The regulatory control of the CCPs is conducted in so-called supervisory colleges, where the Danish Financial Supervisory Authority participates in the supervision of Cboe Clear Europe N.V and Nasdaq Clearing AB.

In 2024, an average of approximately 93,600 trades per day in Danish kroner were settled through ES-CPH, which is an increase of 10.6 per cent compared to 2023, see table 3 and chart 5. This was mainly due to a 15.3 per cent increase in trades in investment fund certificates. The value of settled trades averaged approximately kr. 221.9 billion per banking day, which is a decrease of 1.9 per cent compared to 2023, see table 3 and chart 6. This is mainly due to a decrease in the value of bond trades.

TABLE 3

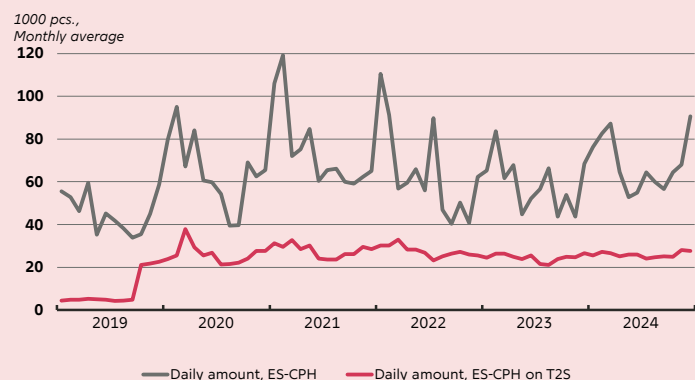
Number and value of securities transactions

Year, average per day	Total		Bonds		Equities		Investment fund certificates	
	Number of transactions, thousand	Value, kr. billion	Number of transactions, thousand	Value, kr. billion	Number of transactions, thousand	Value, kr. billion	Number of trades, thousand	Value, kr. billion
2018	65.5	168.5	2.6	119.0	29.4	40.8	33.5	8.8
2019	67.0	223.1	4.2	180.7	33	34.8	29.8	7.6
2020	90.5	231.5	3.8	178.1	49.0	43.5	37.7	9.9
2021	101.7	226.4	3.9	163.6	49.1	51.0	48.7	11.8
2022	91.3	255.4	5.2	194.6	39.6	51.3	46.5	9.5
2023	84.7	226.3	4.6	165.0	39.8	53.1	40.4	8.2
2024	93.6	221.9	3.8	144.4	43.3	68.6	46.5	9.0

Source: ES-CPH.

CHART 5

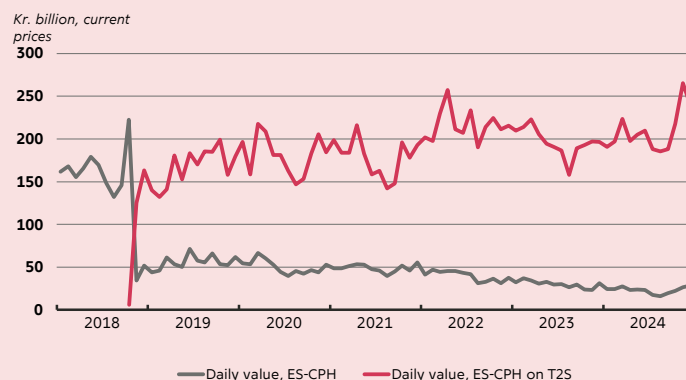
Number of securities trades



Source: ES-CPH.

CHART 6

Value of securities trades



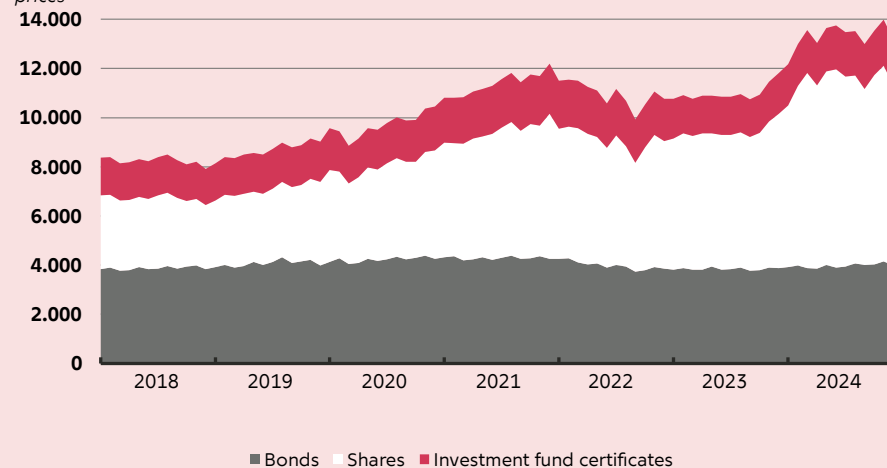
Source: ES-CPH.

The market value of securities held in ES-CPH increased by 11.6 per cent in 2024, see chart 7. This rise is mainly due to increases in the value of shares and investment fund certificates.

CHART 7

Market value of securities held in ES-CPH

Kr. billion, current prices



Source: ES-CPH.

Settlement ratio

The settlement ratio measures the proportion of trades settled on time, i.e. within two days of the trading day.³⁶

Chart 8 shows the settlement ratio for ES-CPH's settlement on T2S and for ES-CPH's own settlement system. It is satisfactory that the settlement ratio in 2024 is generally maintained at a high level.³⁷

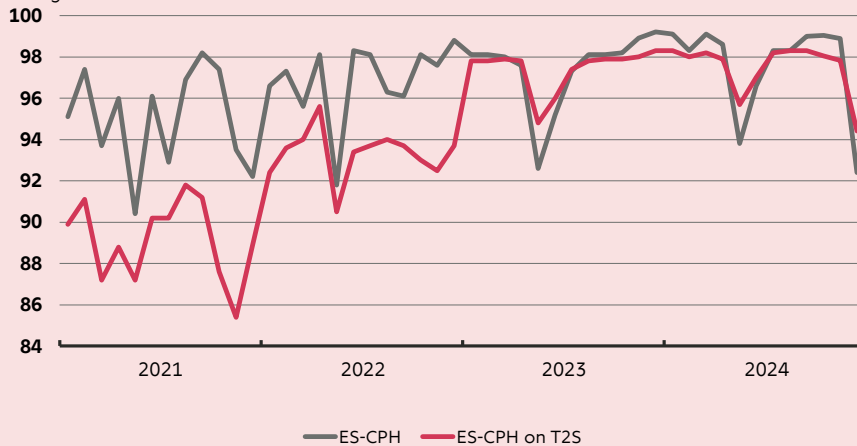
³⁶ According to article 5 of CSDR, securities trades must be settled within two days of the trading day. Work has been initiated to shorten the settlement time so that trades are settled no later than the day after the trading day, see box 5.

³⁷ As in previous years, there was a decrease in May due to a special Danish bank holiday when T2S was open (19 May, the day after Ascension Day). In December, there was also a larger decrease in the settlement ratio due to T2S being open on 24 and 31 December, where Danish banks are closed. There was not a similar decrease in December in 2022 and 2023, as the days in those years fell on weekend days.

CHART 8

Settlement ratio

Per cent, monthly average



Source: ES-CPH.

Operational reliability

The operational stability in the settlement of Danish securities transactions in the ES-CPH settlement was generally satisfactory in 2024.

However, after the new corporate actions system, Megara, went live in June³⁸, there were a number of minor incidents and a major incident in September due to capacity issues and system misconfigurations. The incidents resulted, among other things, in delays and erroneous payments that subsequently had to be reversed. The handling of the major incident also affected Kronos2 and T2S.

ES-CPH has thoroughly followed up on these incidents and addressed the issues identified. Danmarks Nationalbank's oversight assesses that the follow-up on the incidents was satisfactory.

A major incident in TARGET Services in February 2025 also meant that ES-CPH had to postpone the closure of the settlement day for almost six hours and subsequently carry out major efforts to correctly reconcile participants' securities accounts. For more information about the event, see chapter 6, *Payments and securities settlement in euro*.

International standards and cyber resilience

Danmarks Nationalbank oversees whether the settlement of Danish securities transactions in ES-CPH and T2S complies with international standards for financial market infrastructures, in particular the CPMI-IOSCO Principles for Financial Market Infrastructure, PFMI, and related cyber resilience guidelines.

Danmarks Nationalbank's oversight of ES-CPH is closely coordinated with the Danish Financial Supervisory Authority, as the oversight touches upon many of

³⁸ See a further description in the section on System changes below.

the same elements covered by the Danish Financial Supervisory Authority's supervision of ES-CPH's compliance with the requirements of the pan-European legislation on central securities depositories, CSDR³⁹. In this regard, Danmarks Nationalbank contributes to the Danish Financial Supervisory Authority's ongoing evaluations of whether ES-CPH fulfils the requirements of CSDR (also called review and evaluation).

The oversight of T2S is carried out in collaboration with all central banks connected to the platform, with the ECB as lead overseer and coordinator, see chapter 6, *Payments and securities settlement in euro*.

ES-CPH is continuously working to improve the cyber resilience of its systems and in 2024 continued to work with Danmarks Nationalbank's recommendations from the 2020 assessment of ES-CPH based on CPMI-IOSCO's Cyber Guidance. Danmarks Nationalbank's assessment showed that ES-CPH complies with the Cyber Guidance in most areas. In a few key areas, Danmarks Nationalbank has made recommendations to ES-CPH on how to strengthen cyber resilience. This includes work to strengthen ES-CPH's cyber contingency planning, including the ability to handle extreme but plausible cyber scenarios. Some of the recommendations are still open.⁴⁰

System changes

In 2024, ES-CPH has continued to work on integrating its systems into the Euronext Group. The goal is that the four central securities depositories in the Euronext group⁴¹ will eventually all use the same technical platform.

In June 2024, ES-CPH started using the Euronext Group's new platform for handling corporate actions, CA4U. The use of CA4U will lead to increased automation, transparency and standardisation of the handling of corporate actions across the four CSDs in the Euronext Group. The use of the new platform will also help ES-CPH to comply with the so-called SCoRE standards⁴², which, among other things, sets out requirements for the handling of corporate actions. Compliance with the SCoRE standards is a prerequisite for the use of euro-denominated securities issued by ES-CPHs in the Eurosystem's new collateralisation system, ECMS, which is scheduled to be operational from June 2025. Initially, CA4U will only handle corporate actions for bonds, and from the end of 2025, other types of securities will also be handled here. Until then, CA4U will therefore interact with ES-CPH's existing corporate actions system.

In 2024, ES-CPH also started using the Euronext Group Message Hub to exchange messages between ES-CPH and participants regarding clearing and settlement of trades and payments.

In 2024, ES-CPH has continued to work on phasing out the use of the local settlement platform, the ES-CPH settlement. In November 2024, settlement in Danish kroner was further reduced and finally phased out in March 2025. The same happened for settlement in euros in 2022. Therefore, all settlements in the

³⁹ 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 etc., abbreviated CSDR (*link*), aims to harmonise the timing and conduct of securities settlement as well as the rules for the central securities depositories (CSDs) that operate the settlement infrastructure.

⁴⁰ Danmarks Nationalbank's assessment of ES-CPH according to Cyber Guidance has not been published.

⁴¹ In addition to ES-CPH, the CSDs in Italy, Norway and Portugal are part of the Euronext Group.

⁴² See the ECB's collateralisation standards, *Single Collateral Management Rulebook for Europe, SCoRE (link)*.

two currencies where money is exchanged between participants will now take place on T2S. Settlement of securities transactions via the local ES-CPH settlement will then only take place in Swedish kronor or as so-called free-of-payment trades, FoP.⁴⁵ ES-CPH has decided to phase out the local settlement platform completely in 2027. This is done, among other things, as part of the preparations to be able to settle all securities trades the day after the trading day, also called T+1, see box 5 below. By then, all trades will be settled on T2S.

In November 2024, the auto-collateralisation (Sikkerhedsretten), used to collateralise intraday credit in Kronos2, was also phased out. This is due to the fact that the settlement of payments in Danish kroner from Easter 2025 will take place in TARGET DKK, see chapter 2, *Interbank payments*.

BOX 5

Shortening the settlement time to T+1

During 2024, several markets, including the US, transitioned to settling securities trades the day after the trading day (also known as T+1). Until then, the general standard globally has been two days after the trading day (T+2), as it currently is in the EU. Shortening the settlement time for securities trades has also been discussed in the EU for some time. The same is true in the UK and Switzerland, which are closely connected to the European markets.

On 12 February, the European Commission proposed an amendment to the CSDR that makes it mandatory to settle securities trades by T+1. The European Commission has proposed that the change will apply from 11 October 2027¹, and the European market is now preparing to settle transactions T+1.

At ES-CPH, the preparations include phasing out the layered settlement model used today. By the end of 2027, ES-CPH will therefore completely phase out the use of the local ES-CPH settlement. After that, all securities transactions must be settled on T2S. This simplifies the settlement process and gives the Danish market better conditions to handle a shorter settlement period.

A working group has been set up to coordinate the work of preparing the transition to T+1 for Danish market participants. The group was established under the Danish National Stakeholder Group (DK-NSG) for T2S and includes representatives from ES-CPH, Danish banks and other relevant stakeholders, including Danmarks Nationalbank.

¹ See the European Commission proposal to amend the CSDR ([link](#)).

⁴⁵ In free-of-payment transactions, only the security is exchanged between the seller and the buyer, and there is no money involved in the settlement of the transaction. Money is already rarely exchanged between the parties in these transactions, as they are between a bank and its own customer. In this case, the payment is settled internally within the bank between the customer and the bank itself.

06

Payments and securities settlement in euro

Danish banks use TARGET Services to settle payments and securities transactions in euro. TARGET Services can settle transactions in multiple currencies, and after Easter 2025, all settlement of Danish kroner will be centralised on TARGET Services, see box 2. Payments are settled in T2, the pan-European RTGS system. In T2, participants can also transfer liquidity for settlement in other euro systems, including T2S, TARGET2Securities. T2S is the pan-European system for the settlement of securities transactions. This chapter focuses on the settlement of payments in euros.

TARGET Services is owned by the European Central Bank, ECB, and the national central banks of the euro area and is operated by the 4CB (the four central banks of Germany, France, Italy and Spain) with the ECB as coordinator.

The oversight of TARGET Services is carried out in collaboration between the ECB's oversight function and the other central banks connected to T2 or T2S. Danmarks Nationalbank participates in the joint oversight headed by the ECB, which takes place in working groups with the participation of the national central banks.

Use

In total, around 1,000 banks use T2 to process payments in euros, including 17 Danish banks and branches of foreign banks in Denmark. Danish participants made interbank payments worth an average of EUR 11.1 billion per day in 2024. Danish participants mainly use T2 to execute intra-group payments and payments to foreign participants.

There are a total of 24 CSDs operating in 23 EU countries connected to T2S, including ES-CPH. A bank may settle securities transactions via T2S as either a direct participant, if the bank has a T2S settlement account, or as an indirect participant via a direct participant's access.

A Dedicated Cash Account for T2S settlements is set up through one of the central banks in the EU, including Danmarks Nationalbank. 11 Danish participants have a T2S settlement account in TARGET Services via Danmarks Nationalbank for paying or receiving euro in connection with T2S settlement.⁴⁴

Operational stability

The operational stability of the local components of T2 for which Danmarks Nationalbank is responsible was satisfactory in 2024.

⁴⁴Other Danish participants may have set up a T2S settlement account via other EU central banks.

In 2024, the ECB continued to work on the remaining outstanding actions in the action plan⁴⁵, which was created to follow up on the five serious IT-related incidents (not cyber incidents) that affected the settlement of payments and securities transactions in T2 and T2S in 2020. Danmarks Nationalbank participates in the ECB's follow-up on the action plan under the auspices of the joint oversight of TARGET Services.

On 27 February 2025, a major incident in TARGET Services resulted in the inability to process payments in T2 and T2S for around eight hours in the middle of the day, and the closing of the monetary policy day in T2 and T2S was postponed for six hours. In handling the incident, the emergency solution in TARGET Services, ECONSII, was activated to settle the most time-critical payments. The incident also affected Kronos2, ES-CPH and CLS. See chapter 2, *Interbank payments and centralised settlement of payments in Danish kroner*, chapter 5, *Securities settlement*, and chapter 7, *Foreign exchange settlement*. Danmarks Nationalbank's oversight participates in the follow-up to the incident under the auspices of the ECB's oversight of TARGET Services.

International standards

In October 2023, the ECB launched a so-called comprehensive assessment of T2 and TIPS under the SIPS Regulation on Oversight Requirements for Systemically Important Payment Systems,⁴⁶ as well as an assessment of T2S based on the CPMI-IOSCO Principles for Financial Market Infrastructures, PFMI. Work on the assessments continued in 2024.

In 2024, the ECB continued its work on the recommendations from the assessment of T2S under the Cyber Resilience Oversight Expectations, CROE, which was completed in 2022. Danmarks Nationalbank's oversight participates in the ECB's follow-up of the action plan under the auspices of the joint oversight of TARGET Services.

System updates

The launch of the Eurosystem's new collateral management system, ECMS, has been delayed and is now scheduled for June 2025.

So far, participation in the settlement of payments in T2 and TIPS has mainly been limited to banks. Due to changes in EU legislation, payment institutions and electronic money institutions have been able to apply to participate in the core payment systems, including T2 and TIPS, since April 2025.⁴⁷

⁴⁵ The action plan has had a broad scope and covers measures in change and release management, business continuity management, fail-over and recovery tests, communication protocols, governance and data centres and IT operations.

⁴⁶ SIPS implements the PFMI in an ECB regulation that applies to systemically important payment systems in the euro area.

⁴⁷ In April 2025, changes to the so-called Finality Directive came into effect. The changes allow payment institutions (non-bank payment service providers) and electronic money institutions to participate directly in the settlement of payments in the core payment systems, including T2 and TIPS, without having to go through a bank. However, payment institutions will only have access to settlement accounts in the Eurosystem and will not be allowed to use monetary policy instruments.

07

Settlement of foreign exchange transactions

The foreign exchange market is the largest of all financial markets globally in terms of turnover. Central banks, financial institutions, companies and private individuals all need to buy or exchange currency, for example to buy goods abroad. Foreign exchange transactions in which Danish kroner are bought or sold against another currency can either be settled via correspondent banks or through the international foreign exchange settlement system, CLS.

In settlement through correspondent banks, the two payments in a foreign exchange transaction are not settled simultaneously, exposing the parties involved to a settlement risk. If the payments in different currencies need to be exchanged across time zones, the payments can take many hours or days to process, resulting in a significant settlement risk. Settlement risk in a foreign exchange transaction is the risk that one party pays as agreed but does not receive the purchased currency, which can result in significant losses and potentially lead to systemic consequences.

Settlement risk can be reduced by settling both sides of a foreign exchange transaction simultaneously⁴⁸ (payment-versus-payment, PvP), which is possible in CLS. CLS settlement was launched in 2002 and has since significantly reduced settlement risk on trades across many of the world's most traded currencies. CLS currently settles foreign exchange transactions in 18 connected currencies, including Danish kroner, euro and US dollar. Only foreign exchange transactions where both currencies in the trade are connected to CLS can be settled in CLS. On average, over USD 7,000 billion worth of foreign exchange transactions are settled in CLS every day.

The settlement risk can also be reduced by bilateral netting of mutual payment obligations prior to settlement. CLS offers a bilateral netting calculation service in 120 currencies that provides users with a comprehensive overview of their net payment obligations. Netting reduces the settlement risk in foreign exchange transactions, as netting reduces the amounts that are to be exchanged between the parties to foreign exchange transactions.

CLS is owned by the major international banks participating in the CLS settlement, including Danske Bank and Nordea. Only co-owners can participate directly in the CLS settlement.

Danmarks Nationalbank collaborates with the central banks of the other participating currencies on overseeing CLS, see box 6.

⁴⁸ See Bank for International Settlements, FX settlement risk: an unsettled issue, *BIS Quarterly Review*, December 2022 ([link](#)).

BOX 6**Oversight of CLS**

Oversight of CLS is carried out by a joint CLS Oversight Committee¹, which is a forum for collaboration between the central banks of the participating currencies, through which they can handle their national oversight responsibilities. Danmarks Nationalbank participates in this work, which is led by the US Federal Reserve, which is also the supervisory authority for CLS. Danmarks Nationalbank's oversight focuses especially on matters of importance to the settlement of transactions in Danish kroner.

Oversight of CLS is based on the CPMI-IOSCO principles for safe and efficient payment systems (Principles for Financial Market Infrastructures, PFMI). CLS published its most recent description of how the system complies with CPMI-IOSCO's principles in August 2024.²

¹ See Fed, Federal Reserve System, Protocol for the Cooperative Oversight Arrangement of CLS ([link](#)).

² See CLS, *Principles for financial market infrastructures (PFMI) disclosure, 2024* ([link](#)).

Use

The Danish krone is the 20th most traded currency in the world.⁴⁹ For Danish kroner, approximately 90 per cent of all foreign exchange transactions with Danish kroner as one leg of the foreign exchange transaction are settled in CLS.⁵⁰ The average daily value of transactions in Danish kroner in CLS was kr. 361 billion in 2024. This is an increase of 9.4 per cent relative to 2023, see chart 9.

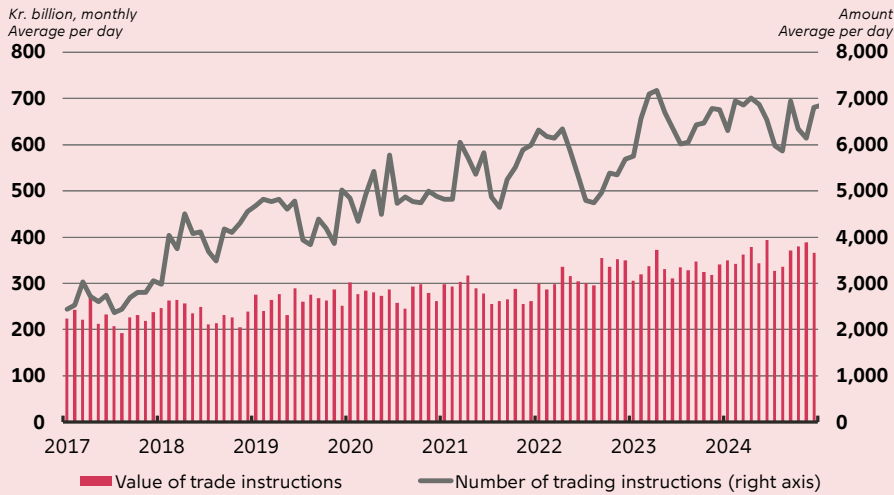
Danish banks and companies can settle foreign exchange transactions via CLS. There are four direct participants in CLS that make payments in Danish kroner to the CLS settlement. In addition, a number of Danish banks and companies participate indirectly in the CLS settlement via one of the four direct participants.

⁴⁹ See Danmarks Nationalbank, Strong growth in krone trading and larger Danish foreign exchange market, *Danmarks Nationalbank Statistical News*, December 2022 ([link](#)).

⁵⁰ Estimated based on Bank for International Settlements, *Triennial Central Bank Survey, OTC foreign exchange turnover in April 2022, October 2022* ([link](#)), and data from CLS Bank.

CHART 9

Trading instructions in CLS



Source: CLS Bank.

Operational reliability and liquidity

The Danish participants reserved sufficient liquidity for the CLS settlement in 2024.

The CLS settlement takes place during a relatively short period of time during the day when the RTGS systems of the connected central banks are open simultaneously across time zones. Payments into and out of CLS are made via the connected central banks' RTGS systems, i.e. for Danish kroner via Kronos2 in 2024 and after Easter 2025 via TARGET DKK. The stability of CLS settlement is therefore dependent on the stability of the connected RTGS systems. Due to the interdependencies between CLS and the RTGS systems of the 18 associated currencies, an event in one RTGS system can propagate to other systems. This was the case in February 2025, for example, when CLS settlement was affected by a major incident in TARGET Services, see chapter 6, *Payments and securities settlement in euro*. Due to the problems in TARGET Services, several participants' euro payments to the CLS settlement were delayed, leading to CLS payouts in several currencies being postponed until early evening instead of midday.

There were no incidents in Kronos2 in 2024 that led to delays in CLS settlement.

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The analysis consists of a Danish and an English version. In case of doubt about the accuracy of the translation, the Danish version shall prevail.

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