Staff Memo

The role of margins in centrally cleared derivatives markets

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Summary

Following the global financial crisis, several types of derivative contracts were required to be cleared at central counterparties (CCPs). This has led to an increased use of margins (collateral) by market participants to cover counterparty risks in derivatives transactions. The use of margins in derivatives markets cleared by CCPs has strengthened the financial system's ability to absorb losses and manage contagion risks, should one or more market participants become insolvent. However, this has come at the cost of increased liquidity risks for market participants. Since 2020, several episodes of market stress have forced market participants to post large amounts of margins to CCPs in a short period of time, in the form of cash and liquid assets.

This Staff Memo explains the purpose of margins. It also describes the factors that CCPs take into account when calculating the amount of margin to be required from market participants to cover their counterparty risks. Understanding and being transparent about how this is done is key to ensuring robust liquidity planning by market participants, as episodes of market stress in recent years have shown. To this end, global standard-setting bodies have recently made recommendations and proposals for policy action at global level. The background to the recommendations and proposals is that one has identified that calculation methods can be made more transparent, and also that one has recognised how the liquidity preparedness of market participants can be strengthened.

Developments in Sweden largely mirror global developments. Today, however, the Swedish financial system is more resilient to liquidity risks associated with margins than in the past, following lessons learnt from previous episodes of market stress. It is nevertheless important that the global recommendations are implemented, which means that both CCPs and market participants need to pay close attention to liquidity risks in the future. To safeguard financial stability, it is important that derivatives markets are cleared by CCPs and that calculation methods are transparent, but also that market participants have robust liquidity preparedness.

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1 Introduction

1.1 Central clearing has led to reduced counterparty risks

Mandatory central clearing requirements have been introduced for several types of derivatives transactions. This has led to the increased importance of central counterparties (CCPs) in the financial system, as well as to the increased use of margins in the form of cash and non-cash collateral since the global financial crisis of 2007-2008 (ESRB, 2020; BCBS-CPMI-Iosco, 2022).[2]

The purpose of increasing the role of CCPs in the financial system was to address the lack of transparency and risk management in derivatives markets, see the box "What does clearing a derivative contract at a CCP entail?". The growing systemic importance of CCPs is illustrated by the fact that, according to the BIS (2023), around 80 per cent of the total notional amount outstanding of interest rate derivatives worldwide was cleared by CCPs in 2023. This is a consequence of the increased requirements and incentives for central clearing of derivatives.[3] The increased share of central clearing has thereby reduced the risk of building up counterparty risks that are difficult to monitor. In particular, the increased use of margins, combined with central clearing, has helped to make the financial system more robust in the event of the insolvency of one or more market participants. This is not least because it has reduced the risks of contagion.

Margins are characterised by counterparties in a derivative contract exchanging cash and high quality non-cash collateral with one another, to cover the counterparty risk between them. That is, the risk that one party will be unable to fulfil its contractual obligations to pay or deliver securities, causing the other party to incur credit losses. In a centrally cleared derivative transaction, market participants need to post margins to a CCP, which is part of its risk management.

However, the increased use of margins may also be associated with problems under certain conditions. Indeed, a number of episodes of market stress since 2020 have shown that large increases in the amount of margins required to be exchanged can come at the expense of increased liquidity risks for market participants. This occurred mainly in centrally cleared markets where CCPs require margin from market participants, but also to some extent in non-centrally cleared markets (BCBS-CPMI-Iosco, 2022).[4] Thus, during periods of market stress, CCPs can require large amounts of margins from market participants at short notice to manage increased counterparty risks. This may put financial pressure on market participants and require them to use their

[2] These were some of the measures included in the G20 reform programme initiated after the global financial crisis to reduce vulnerabilities and risks in preparation for future crises.

[3] Following the global financial crisis, increased risk management requirements for non-centrally cleared derivatives were also introduced, including requirements to exchange margins. It aimed to reduce counterparty risks overall and to promote central clearing (BCBS-CPMI-Iosco, 2022).

[4] In a non-centrally cleared derivatives transaction between two counterparties, the parties exchange margins with one another and in a manner where the margin is protected from the insolvency of the party where it is held.

liquidity buffers. Not least because an inability to meet a CCP's increased margin requirements in a timely manner can result in a market participant defaulting and the CCP incurring losses.

According to the Sveriges Riksbank Act, the Riksbank is tasked with overseeing the financial system, with the aim of contributing to its stability and efficiency. Central clearing and the role of margins in the financial system are areas that are relevant for financial stability and which the Riksbank therefore follows closely. The Riksbank oversees the Swedish CCP Nasdaq Clearing and participates in international cooperation between authorities to oversee two foreign CCPs that clear Swedish markets: the UK's LCH Ltd and the Dutch Cboe Clear Europe.[5] All three CCPs are important for financial stability in Sweden, as they have links to Nordic banks as well as market participants and are participants in the Riksbank's payment system RIX-RTGS.

This Staff Memo first explains how the use of margins can lead to liquidity risks, and why this may have implications for financial stability. It then describes what margins are and why they are important tools for managing counterparty risk in derivative contracts.[6] Particular focus is placed on describing the overarching factors that determine how CCPs calculate the amount of margin to be required from market participants. It thus illustrates what can affect market participants' liquidity needs and behaviour during market turmoil, as it tends to increase margin requirements in centrally cleared markets in particular. The Staff Memo concludes with a brief description of the policy proposals put forward at global level. The conclusion also describes the lessons to be learnt from the liquidity risks associated with margin requirements. The policy proposals aim to address these liquidity risks.

FACT BOX – What does clearing a derivative contract at a CCP entail?

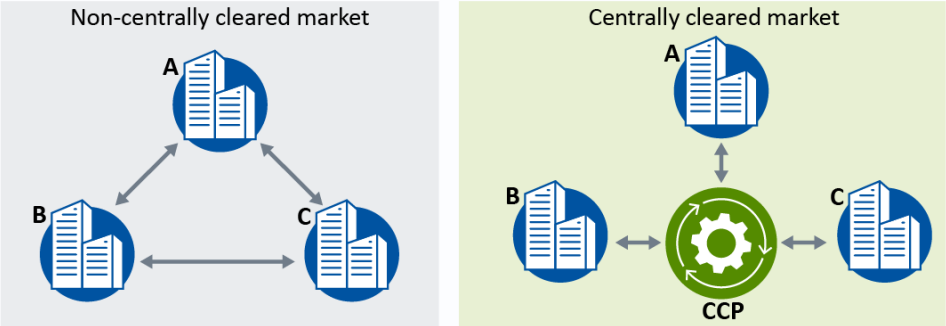
The contract is replaced by two new ones when a derivative contract is centrally cleared, i.e. at a CCP. The CCP becomes the buyer to the seller and the seller to the buyer in the original contract (this is called novation). The CCP thus becomes the new legal counterparty to the two counterparties to the original contract, thereby taking over the counterparty risk that previously existed directly between the counterparties (see Figure 1Figure 1).[7]

[5] See Chapter 3, Sections 8-9 of the Sveriges Riksbank Act (2022:1568).

[6] Although the focus is on derivative contracts, it is important to emphasise that the overarching principles also apply to other types of financial instruments. Exchange-traded cash equity transactions are also cleared by CCPs, as are, to varying degrees, bond cash and repo transactions. The United States is also planning to introduce central clearing requirements for US Treasury bond cash and repo transactions. For further information, see SEC (2023).

[7] Clearing of other financial instruments works in the same way. An example of this is when a cash equity transaction is cleared. It is then split into two new transactions where the CCP acts as an intermediary. In this way, counterparty risk is managed between the time when the transaction is executed and when it is settled, i.e. when money and equities change hands.

Figure 1. Illustration of what central clearing entails



Note. In a non-centrally cleared market, the participants may have many different counterparties, which increases contagion risks in the event of a market participant default. See the figure on the left, where participants A, B and C have concluded agreements with one another. In a centrally cleared market, the CCP instead becomes the market participants' only counterparty, which also helps to streamline payment flows through multilateral netting, see the figure on the right.
Source: The Riksbank

Market participants that clear derivatives contracts at a CCP must become a clearing member of the CCP, which requires the participant to fulfil strict regulatory requirements on operational and financial capacity. This means that clearing members are normally large financial institutions, such as banks, but there are exceptions. Market participants who, for various reasons, are unwilling, unable or prohibited from clearing their transactions at the CCP must therefore do so indirectly via a clearing member acting as an agent (so-called "client clearing").

Normally, the CCP is only an intermediary to its clearing members and therefore has no open positions – this is known as a balanced book. That is, all clearing members' positions are fully offset with one another because the CCP has as many buy and sell positions. However, the CCP has counterparty risk towards its clearing members. An important tool for the CCP to manage this risk is to require margins from clearing members. However, in the event of a clearing member defaulting, the CCP will have an unbalanced book and may thereby incur losses that the margins are intended to cover. Losses may arise due to the fact that the CCP still has to fulfil obligations in cleared derivative contracts towards non-defaulting clearing members in the place of the defaulted clearing member. The primary role of the CCP is to guarantee obligations in the event of a default, thereby preventing its consequences from spreading through the financial system. This risk is greater in a non-centrally cleared market, where financial problems of one market participant can spread to many bilateral counterparties (see Figure 1).

The CCP's losses may increase as a result of unfavourable market price movements. For this reason, time is of the essence – the CCP must close out a defaulted clearing member's derivative positions as quickly as possible in order to return to a balanced book.

At the same time, a default is likely to occur during stressed market conditions, which in itself increases the risk of unfavourable market price changes. [8]

1.2 Counterparty risks in derivative contracts can be high

A derivative contract is a type of financial instrument for which the value of the contract usually depends on one or more underlying assets, such as interest rates, exchange rates, equities, commodities or credit. Examples of derivative contracts are swaps, futures and options. Derivatives are often linked to one or more future obligations. Such obligations may be to deliver one or more securities or commodities, or to make one or more interest payments based on a notional amount. The purpose of using the contracts may be to hedge against future market price changes or to speculate on future market price movements.

However, there is a risk that one of the counterparties to a transaction may become insolvent and fail to fulfil its part of the obligation. This means that the non-defaulting counterparty risks incurring credit losses due to the non-receipt of one or more payments or one or more securities.

The risks associated with derivative contracts can be high, not least because they can have long maturities (sometimes many years) and large notional amounts, where regular as well as significant obligations may need to be met between the counterparties to the contract. Longer maturities generally mean that market participants can build up greater counterparty risks over time, and that there is a greater risk that one of the parties to a contract will default before the contract expires.

2 Margins reduce counterparty risks at the cost of increased liquidity risks

A CCP requires margin from market participants to manage counterparty risk in derivative contracts and other types of financial instruments. However, this may translate into increased liquidity risks for market participants if counterparty risk increases sharply, which in turn may lead to CCPs having to require large amounts of margins at short notice. An inability to meet a CCP's increased margin requirement in a timely manner may result in the default of a market participant. This in turn could affect financial stability if the CCP does not have sufficient margins and other financial resources to absorb the losses arising in such a situation.

However, there are other aspects where increased margin requirements may create risks. If market participants have insufficient liquidity to meet their increased margin

[8] In addition, losses may also arise as a consequence of the CCP closing out the positions, for example through an auction. Bidders are likely to demand a premium from the CCP for being willing to take over the positions being auctioned. Therefore, in a standard auction procedure, the bidder offering the *lowest* premium and thus the lowest losses for the CCP wins. Bidders in an auction are normally clearing members of the CCP, but could also be indirect clearing members (clients).

requirements, their only option may be to close out their derivative positions by entering into new, but offsetting, positions in similar derivative contracts. The risk is that it puts further pressure on market prices, which in turn increases margin requirements for those participants that still hold positions in the same type of derivative contracts (ESRB, 2020, 2024).

Another risk is that market participants may be forced to sell assets. In the worst case scenario, this would be a fire sale, at a discount or at falling prices, to fulfil their liquidity needs to meet margin requirements quickly enough with the right type of funds. This, in turn, could lead to further price declines and reduced liquidity in the securities markets concerned. These self-reinforcing price spirals are shown in Figure 2.

Figure 2. Market price changes can lead to a self-reinforcing price spiral

Note. A change in the market price (or a market rate) may cause a CCP to require more margins from market participants. If their liquidity is limited, market participants may then need to sell assets to fulfil their liquidity needs or to close out their positions. Overall, this could put further pressure on market prices.

Source: The Riksbank

There have been a number of episodes where market stress has led to large increases in margin requirements, which have either caused or risked negative price spirals. In March 2020, centrally cleared markets in particular were characterised by large increases in margin requirements, contributing to a period that came to be known as the "dash for cash" (FSB, 2020).[9] Without central bank intervention, there would also have been a risk that certain types of market participant would have been forced to sell securities at falling prices (BCBS-CPMI-Iosco, 2022; ESRB, 2024a).

[9] Non-centrally cleared markets were also affected, mainly through increased variation margin requirements. Increases in initial margin requirements were relatively limited compared to centrally cleared markets (BCBS-CPMI-Iosco, 2022).

In addition, in September 2022, UK pension funds were put under severe liquidity pressure. The liquidity pressure stemmed from requirements to post additional collateral in UK government bond repo transactions and from increased margin requirements on interest rate swap positions, which were partially cleared at a CCP. In this case, the pension funds were forced to sell UK government bonds at falling prices to meet requirements in time, contributing to a negative price spiral. The negative price spiral led the Bank of England to temporarily purchase long-term government bonds to stabilise the market (Andersson, 2023; ESRB, 2024a).

Large increases in margin requirements also hit centrally cleared commodities and energy derivatives markets during the 2022 energy crisis – markets in which several non-financial corporations are active and play an important role (FSB, 2023). This applies not least to the Nordic power derivatives market, which at the time was cleared by Nasdaq Clearing. This example is described in more detail in the box "Large increase in margin requirements for Nasdaq Clearing's clearing members during the 2022 energy crisis" in Chapter 3.

However, it is important to emphasise that margins play a crucial role in managing counterparty risk. As their use can create liquidity risks, it is important to understand what margins are and how CCPs calculate the amount they should require from market participants. This is described in the following chapter.

3 Margins are key to manage counterparty risk

From now on, a market participant that clears a derivative contract directly at a CCP is referred to as a "clearing member", see the box "What does clearing a derivative contract at a CCP entail?" in Chapter 1. A clearing member must meet the margin requirement set by the CCP on the member's position in the derivative contract. The margins required by the CCP from the clearing member shall always reflect the counterparty risk that the CCP has towards the member in the derivative position and for as long as the position is open. Margins are divided into two key categories: initial margin (IM) and variation margin (VM). In simple terms, IM and VM are two main components of the margin requirement that a clearing member must always fulfil by posting margin to the CCP. That is, the value of the collateral provided as margins must be at least equal to the level of the margin requirement.

There are strict requirements on the types of margins accepted by a CCP.[10] Therefore, it usually involves cash in relevant currencies and securities with low liquidity, credit and market risks. But it could also involve other types of assets, such as bank guarantees and gold. Securities are also subject to a valuation deduction (”haircut”), to take account of any depreciation in value. This is important if the CCP needs to liquidate securities, to guarantee obligations and manage losses in the event of a clearing member default.

Examples of the assets that clearing members post as margin to CCPs include, in particular, government bonds in the EU and the United States and cash in Asia and Oceania (Aldasoro et al., 2023). [11] However, this may vary among individual CCPs in different jurisdictions. For example, at the end of December 2024, the majority of margins posted at Nasdaq Clearing consisted of covered bonds and cash, government bonds and cash at Cboe Clear Europe and government bonds at LCH Ltd.[12]

Margins in the form of IM play a central role in a CCP's risk management framework, as they are a CCP's first line of defence for managing losses in the event of a clearing member's default. More specifically, it is the topmost and most important layer of prefunded resources aimed at covering the losses incurred in the event of a clearing member default under "normally stressed market conditions". It is to be understood as the bulk of the potential losses that may be incurred and that the defaulted member should cover these itself (this is known as the "defaulter pays" principle). In addi-

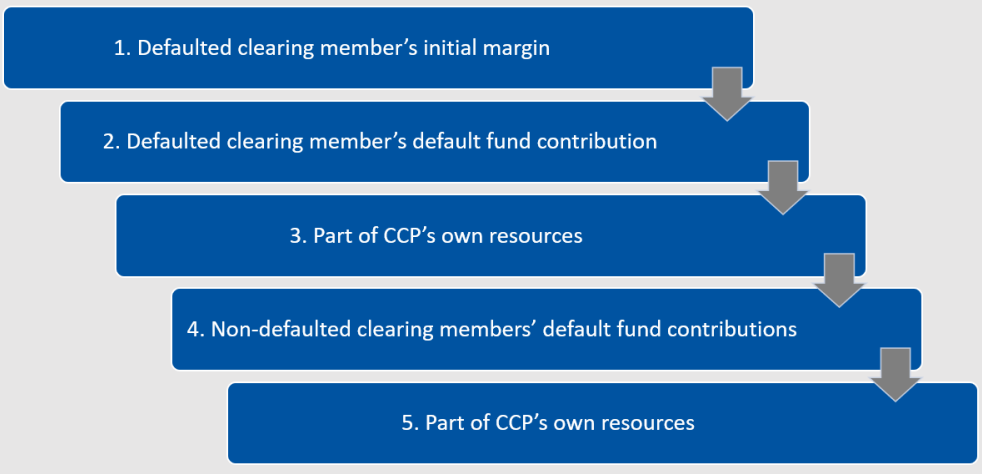
[10] The global requirements for CCPs regarding margins and the application of IM and VM are set out in the international principles and guidelines issued by CPMI-IOSCO (2012, 2017).

[11] How clearing members post their margin to CCPs in practice depends on the arrangements a CCP applies. For example, clearing members can deposit cash in a CCP's accounts with commercial banks, while securities can be deposited in a CCP's accounts with central securities depositories (CSDs) or custodian banks.

[12] This is based on data from the CCPs' published public quantitative disclosures for the fourth quarter of 2024.

tion to IM, a CCP has several layers of resources that can only be used in a specific order according to what is commonly referred to as the "waterfall principle".[13] A schematic description of a CCP's waterfall, as required for EU CCPs, is shown in Figure 3Figure 3Figure 3 below.

Figure 3. A CCP's waterfall of prefunded resources to cover losses in a clearing member default



Note. A CCP has prefunded resources to cover losses in the event of clearing member default. These resources are distributed in different layers and may only be used in a predetermined order. Margins (IM) are the first and most important layer, as they aim to cover the majority of all losses. If pre-funded resources are insufficient, the CCP needs to activate its recovery plan or, in the worst case, be placed in resolution.

Source: The Riksbank

The remaining resources in the waterfall are to be used in "extreme, yet possible, market conditions" in the event that a defaulted clearing member's margin (IM) with the CCP proves to be insufficient. Please also note that the clearing member's contribution to the default fund must be used before the other clearing members' contributions are used.[14] For CCPs, IM is thus the single most important prefunded resource for managing losses that may arise if clearing members default. But it is also important not to build up counterparty risks over time *before* a default actually occurs, and the purpose of the VM is to prevent such risks from building up. The next two sections describe the purpose of VM and IM requirements, as well as how they are calculated. These requirements contributed to increasing the liquidity needs of market participants in March 2020 and during the 2022 energy crisis, among others. As market participants' need for liquidity increased, their liquidity risks increased.

[13] Among other things, the CCP itself needs to contribute own resources to the waterfall. In addition, clearing members need to contribute financial resources to a CCP's default fund on a pro rata basis. The default fund aims to spread losses among clearing members. Non-defaulting clearing members' IMs are not used to cover losses in the event of clearing member default.

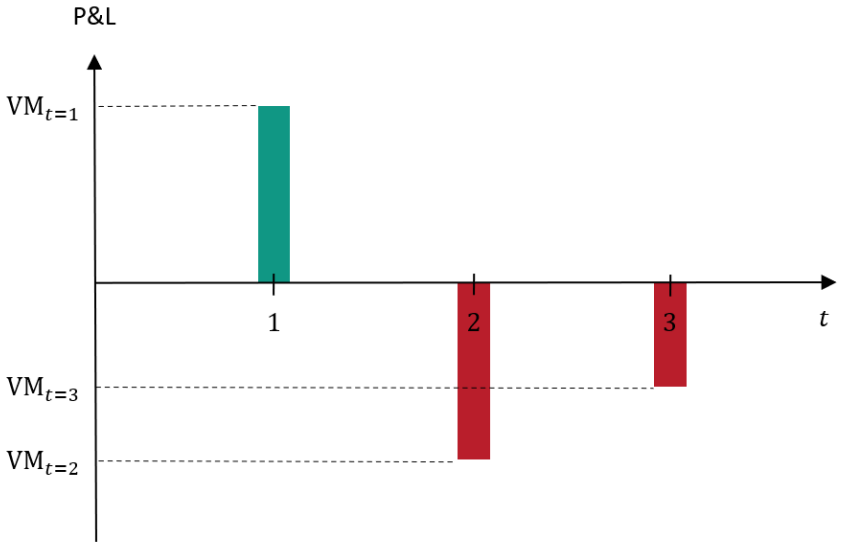
[14] However, clearing members' contributions to the default fund are relatively small in comparison to their posted margins.

3.1 Variation margin – collateral to cover changes in the value of a derivative position that have already occurred

VM is a "backward-looking" tool to settle profits and losses (P&L) incurred in a derivative position. Any profits and losses are typically settled at least once a day, with VM being exchanged between clearing members (via the CCP) from the inception of the derivative contract until its expiration. This means that the total amount of losses does not have to be settled all at once when the contract expires, but is settled in stages. In this way, the VM helps to limit the build-up of counterparty risk over time.

An example of when it may be limited is when there has been a negative change in the value of a clearing member's derivative position between yesterday and today, due to an unfavourable market price change. Such price changes may, for example, relate to the price of a single stock future or to a change in interest rates in the case of an interest rate swap. The clearing member then receives a VM requirement from the CCP corresponding to the size of the loss in the position, and this requirement must typically be met tomorrow with margins. Conversely, a clearing member with an opposite position in the same derivative contract has made a position profit, and it receives from the CCP the margins that the clearing member that made a loss had to post to the CCP to meet its VM requirement. Note that the VM may thus create a need for liquidity on one day, but an injection of liquidity on another. Figure 4 illustrates how VMs are exchanged, while a practical example with a futures contract is shown in APPENDIX - Example calculations with an equity futures position.

Figure 4. Illustration of VM requirements at different times



Note. The figure shows how VM requirements can be both positive (green) and negative (red) at different times. In this case, the clearing member receives at $VM_{t=1}$ at $t = 1$ due to a favourable market price change between $t = 0$ and $t = 1$. At times $t = 2$ and $t = 3$ it has to post VM to the CCP due to unfavourable market price developments.

Source: The Riksbank

In derivatives markets, the VM requirement normally needs to be met with cash in the relevant currency, to facilitate the operational management of the transfer (BCBS-CPMI-Iosco, 2022; ESRB, 2020). This is because, on the same day, the CCP must transfer an amount of funds equal to the VM requirement to the clearing member with the opposite position in the "same" derivative contract, and which has thus conversely made a mark-to-market profit.[15] From a practical point of view, this is normally more difficult to do with securities, and they can also fluctuate in value. In an economic sense, it can therefore be considered as a *payment requirement* or a cash flow*,* rather than a requirement to post collateral.[16]

That is, VM is margin to a settle incurred losses and that a clearing member must post to the CCP. Therefore, in principle, no models are necessary to calculate VM requirements.[17]

3.2 Initial margin - collateral to cover potential future changes in the value of a derivative position

In contrast to VM, IM is a forward-looking tool that aims to cover future exposure in a derivative position, i.e. the losses that a CCP may incur if clearing members default. Such losses can be, for example, in the form of VM or other obligations. More specifically, they are the losses resulting from market price changes under normally stressed market conditions and for a limited time. That is, from the moment the clearing member defaults until the CCP has closed out the position and returned to a balanced book (see the box “What does clearing a derivative contract at a CCP entail?” in Chapter 1).

When a clearing member clears a derivative position, it will have to meet an IM requirement issued by the CCP that reflects the exposure that the CCP gets towards the clearing member in the position. The IM requirement at a given point in time is then an estimate of the losses that, at the moment, can be incurred in the derivative position under specific conditions. Therefore, please note that the level of the IM requirement is typically adjusted at least once a day until the derivative contract has expired (or the position in it has been closed out prematurely). This is to account for the possibility that the exposure in the derivative position may change over time due to, for example, higher market volatility.

[15] In some derivative contracts, losses are settled daily, however, CCPs do not transfer VM to clearing members with profit positions until the derivative contract has expired.

[16] In legal terms, it could be considered collateral depending on whether a derivative transaction is classified as settle-to-market (STM) or collateral-to-market (CTM). If it is classified as an STM, a clearing members's profit and losses are settled (reset to zero) on an ongoing basis with payments. If it is instead classified as a CTM, profit and losses (exposure) are aggregated over time (not reset to zero) until the derivative contract expires. Meeting a VM requirement can therefore be considered as providing margin to cover the cumulative exposure.

[17] However, models may be necessary to price illiquid or non-marketable derivative contracts.

To calculate exposures resulting from normal stressed market conditions, and thus determine a clearing member's IM requirement, CCPs use statistical models in which three general parameters are particularly important.[18]

Three general parameters form the basis for IM model calculations

Typically, modelling of IM requirements on a derivative position involves calculating relative, or absolute, amounts by which the market price of the derivative's underlying asset changes. As concrete examples, it could for example be a certain percentage of the price of single stock future or a certain number of basis points in a particular interest rate, respectively. In this case, the percentage and basis points represent the volatility of the underlying asset. Subsequently, an evaluation of the changes in value that this volatility in turn causes in the derivative position over a given period of time is made. The change in the value of the derivative position thus depends on the market price changes of the underlying asset and on the size of the position. If it is a single stock future, the size refers to how many shares will be bought or sold when the contract expires, and if it is an interest rate swap, it refers to a certain notional amount on which interest payments are based.

There are several models for calculating IM requirements, and the models can depend on several different parameters.[19] However, there are three parameters that form the basis of almost all models:

- *Liquidation period*
  The estimated time horizon required for the CCP to close out a position - a period of time known as the margin period of risk (MPOR).

- *Confidence level*
  IM should with a given statistical certainty cover the potential future changes in value (exposures) in the position that can occur during the liquidation period.

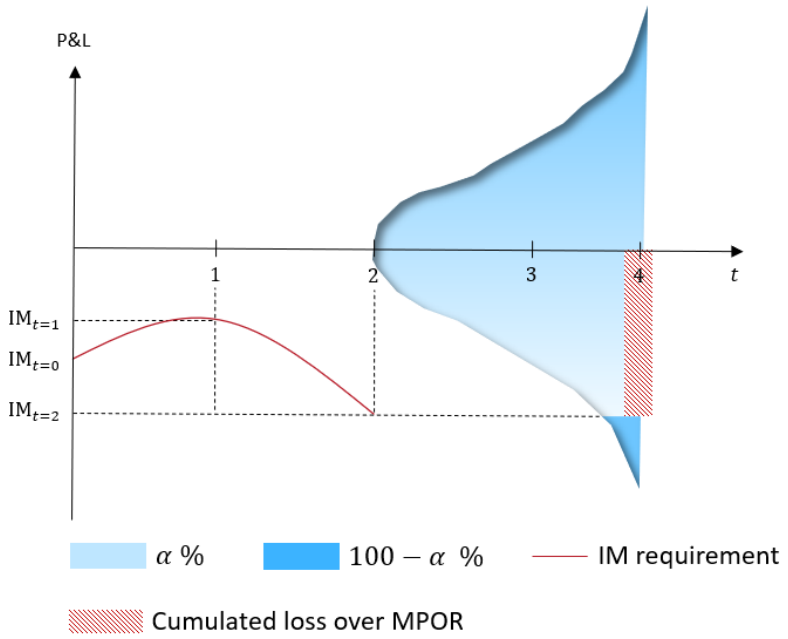
- *Lookback period*
  A period that includes historical market price movements in the derivative's underlying asset in order to capture volatility. The period extends back a significant number of days in order to include days of market stress.

[18] CCPs also use stress test models that apply extreme but possible scenarios. They are used to determine how much prefunded resources, including the default fund, a CCP needs in total.

[19] Examples include the Standard Portfolio Analysis of Risk (SPAN) and models based on the Value-at-Risk (VaR) and Expected Shortfall (ES) risk measures.

Thus, these three parameters are important components for estimating potential future changes in the value of a derivative position, and there are regulatory requirements on their magnitude.[20] In Figure 5Figure 5 a schematic example is given of how the calculation of IM requirements takes into account these parameters.

Figure 5. Illustration of how IM requirements are calculated at a given time



Note. The example shows how the IM requirement on a derivative position entered into at $t = 0$ changes over time. The calculation of the IM requirement at $t = 2$ ("today") is based on an MPOR of two days and with the confidence level α (for example 99 percent). That is, α percent of all future potential changes in value over the MPOR are less unfavourable. The distribution of all potential future changes in value (blue) reflects the volatility present in a lookback period, (for example, market returns in the last 252 days before $t = 2$). The IM requirement that must be met at $t = 2$, i.e. $\mathrm{IM}_{t=2}$, will thus correspond to the estimated cumulated loss over MPOR (red bar).

Source: The Riksbank

CCPs rarely change the size of these parameters in their models. Instead, changes in the level of the IM requirement for a derivative position depend largely on the historical market price movements that currently exist in the lookback period. This means that if a longer period of low volatility is followed by a period of high volatility, the rolling lookback period will eventually include the days with higher volatility. At the same time, low volatility days far back in time will fall out one by one, as the lookback period is rolled forward daily. All else being equal, this leads to increased IM requirements. Note therefore that IM models may be sensitive to sharply increased volatility in the market if that was to occur, as they are usually calibrated using historical data.

[20] For example, the EU regulation governing CCPs in the EU (EMIR) requires MPOR to be at least five business days for OTC derivatives and at least two business days for other derivatives. In addition, IM obligations should at least cover changes in the value of OTC derivatives with a 99.5 per cent confidence level, and other derivatives with a 99 per cent confidence level. The lookback period needs to be at least the most recent 12 months to cover a sufficient number of historic market price movements.

However, there are ways to minimise the risk of sharp increases in IM requirements in such situations, which we will discuss later.

However, for some types of derivative contracts, it is important to note that IM requirements may increase even if volatility remains unchanged. A higher market price of the underlying asset may result in relatively larger changes in the value of the derivative position than at lower prices, for a given volatility level. This occurs if an IM requirement on a derivative contract is set as a given percentage change in the current market price of the underlying asset, where the given percentage represents the volatility in the lookback period. Therefore, a strong driver of changes in IM requirement may be that the market price of the underlying asset has changed but volatility has not. Overall and somewhat simplified, the calculation of IM requirements on a derivative position can be regarded as a function of the level of, and volatility in, the price of its underlying asset. One example of this is the large increases in IM requirements at Nasdaq Clearing during the 2022 energy crisis, as described in the box "Large increase in margin requirements for Nasdaq Clearing's clearing members during the 2022 energy crisis" later in this chapter.

In contrast to VM requirements, a clearing member can meet IM requirements with both cash and non-cash collateral. This then becomes a form of collateral that is temporarily "locked up" at the CCP to cover the applicable IM requirement.[21] This means that if a clearing member's IM requirement have increased from yesterday to today, the member needs to post additional margin to the CCP to cover the level of the increase that has occurred. In this way, IM differs from VM, where every new VM requirement must be met in full as it reflects an incurred loss in a position. Changes in IM requirements can therefore be seen as changes in a stock, while changes in VM requirements can be seen as a flow. A practical example of how the IM requirement on a single-stock futures contract is calculated is shown in APPENDIX - Example calculations with an equity futures position.

IM requirements may be reduced due to netting of different derivative positions

In practice, calculating IM requirements is more complex than in the case of a single derivative position. Clearing members often have a portfolio of many different derivative positions cleared at a CCP. In such cases, the calculation of IM requirements becomes more complex, as the IM requirement for the portfolio is rarely the sum of all individual IM requirements on each derivative position. The reason is that relatively large reductions in the portfolio requirement can be achieved as a result of netting effects. This is because the market values of the different derivatives may correlate, for example via the market price movements of their underlying assets. It also means that the IM requirements on the individual derivative positions are sometimes allowed to be netted against each other. Netting can occur both between derivatives that have

[21] Title to securities is normally not transferred to a CCP upon pledging, but remains to the clearing member. However, the CCP have the right to claim the securities if the clearing member defaults. Cash is subject to title transfer to a CCP, however. Nevertheless, subject to certain exceptions, the clearing member has the right to withdraw margins provided that the IM requirement is still met at the time (i.e. it is possible to withdraw excess collateral).

the same underlying asset as well as between derivatives that have different underlying assets.[22]

The economic rationale for allowing netting is that a potential future loss in a short derivative position can be offset against a potential future profit in a long derivative position, or vice versa. This is however provided that there is a strong correlation between the underlying assets of the derivatives. CCPs therefore need to ensure that this correlation is underpinned by a strong economic rationale and is reliable over a historical time period that includes market stress. Although there should be a historical correlation between two different underlying assets, there is always a risk that the correlation will be broken momentarily and that the IM requirements will thus be too low.

Tools used to reduce procyclicality in IM requirements

Rapidly rising volatility and/or large market price changes can cause margin requirements to increase rapidly and sharply. This means that IM and VM requirements are procyclical in nature, i.e. they are positively correlated with fluctuations in market conditions. There is thus a risk that market stress will entail sharp increases in IM requirements and cause liquidity problems for clearing members. This is because they are forced to post additional collateral to the CCP at short notice to meet the increased requirements.

Therefore, under normal market conditions, CCPs impose higher IM requirements on their clearing members than the "core requirements" CCPs calculate by using their IM models. CCPs set the higher requirements by applying so-called anti-procyclicality tools (APC tools). The purpose of the higher requirements is to minimise the risk of destabilising increases in IM requirements during market stress. There are different variants of APC tools that can be applied by CCPs for this purpose. Whichever tool is applied, in practice it means that a direct or indirect buffer is added to the core-requirement. The buffer can be utilised when core requirements increase significantly, so that clearing members do not have to post more collateral at short notice, at least until the buffer is exhausted.

Thus, note that the risk of large increases in IM requirements can be reduced with APC tools, which is in contrast to VM requirements which by definition are a settlement of an already incurred loss.

CCPs can put add-ons to IM requirements to cover risks that models do not take into account

There are also several types of discretionary add-ons that a CCP may choose to add to the IM requirements. These aim to cover risks that the IM models cannot automatically take into account and that are not reflected in the core requirements. For exam-

[22] As an example, netting can occur between different positions in index futures that have OMX Stockholm 30 as the underlying asset. Netting can also take place between different positions in different but relatively related underlying assets, for example OMX Stockholm 30 and OMX Copenhagen 20.

ple, endogenous factors such as the ability of a CCP to close out positions in the market if a clearing member has a concentrated derivatives portfolio. A concentrated derivatives portfolio relative to the market could, for example, be a portfolio of large positions in interest rate swaps in Swedish kronor relative to the size of the market for these. If the clearing member defaults, the process of closing its positions may take longer and cost more than expected. This is because the time and cost are influenced by the market's capacity or willingness to take over the positions. The process may then affect the market pricing of the positions, thereby amplifying the losses estimated in the core calculation, which does not take into account these potential aggravating factors.

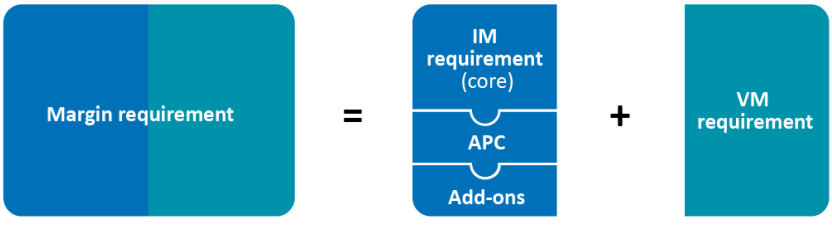
Another example is an add-on that takes into account wrong-way risk. It is a type of correlation risk whereby additional losses may arise if a clearing member holds positions in a derivative whose underlying asset has been issued by the clearing member itself or by a company of the same group.

These types of add-ons can help reduce counterparty risks in a positive way. However, there is a downside in that the add-ons are often discretionary, and there may be a lack of transparency in how CCPs calculate them. Not least because, unlike APC tools, there are no legal requirements or guidelines on how to calculate them. Greater transparency on how they are calculated can create more opportunities for clearing member to manage the liquidity risks they may face due to the add-ons.

3.3 Margin requirements have to be met at least once a day

A CCP calculates its clearing members' margin requirements on an ongoing basis, and IM and VM together constitute a clearing member's total margin requirement. Simplified somewhat, this means that the margin requirement that a clearing member needs to meet on its derivatives portfolio can be described as Figure 6.

Figure 6. Margin requirements are divided into two components



Note. The margin requirement that a clearing member must meet at a CCP is divided into IM and VM requirements. The IM requirement is adjusted using APC tools and may also include certain types of add-ons. The VM requirement can usually be seen as a separate payment requirement.

Source: The Riksbank

Margin requirements are updated to take account of market price changes and changes in volatility

As previously mentioned, a clearing member typically needs to meet an updated regular requirement at least once a day and at a given time (BCBS-CPMI-IOSCO, 2022). The margin requirement that must be met at this point take into account market price changes and changes in volatility that have occurred between the two previous trading days. They also take into account market prices as well as the positions held by the clearing member at the end of the previous trading day, so-called end-of-day (EoD).

The updated margin requirement reflects both the VM and IM of the clearing member's derivatives portfolio. A margin requirement may therefore change from one day to the next, given what the VM requirement will be and changes in the IM requirement. This means that, depending on whether the VM requirement is positive or negative, a clearing member's margin requirement can be either higher or lower than its total IM requirement on its derivative positions. Remember that negative VM requirements will generally need to be paid in cash if a clearing member has made aggregate losses in its derivatives portfolio, and this may therefore affect the clearing member's liquidity needs.

Larger increases in margin requirements may give rise to margin calls

A clearing member may need to meet margin requirements more than once per day if there are unfavourable market price movements in its derivatives portfolio during the day, in particular during market stress. A clearing member may also do so if it makes position changes in the portfolio if the entails larger exposure. CCPs typically have a threshold that determines when a clearing member must provide additional collateral due to an excessive increase in the margin requirement during the day. The threshold can be set at both absolute and relative levels in relation to the value of a clearing member's already posted collateral. The level of the margin requirement may exceed the value of the collateral with the threshold by, for example, a certain number of millions of Swedish krona or a certain percentage. In such a case, CCPs issue an intraday (ITD) margin call.[23] However, ITD margin calls are often issued at scheduled times, although they can also be ad hoc (BCBS-CPMI-IOSCO, 2022).

The purpose of ITD margin calls is to ensure that the CCP has sufficient collateral overnight, in case the clearing member defaults before the next regular update of the margin requirements (EoD), which takes place the following day. Note that CCPs may allow clearing members to post securities to cover an ITD margin call, even if this is due to increased VM requirements (ESRB, 2020). However, the clearing member needs to meet the VM requirement in cash on the next trading day. In other words, the requirement to pay in cash is only postponed, as CCPs do not normally transfer funds to cover ITD margin calls driven by VM to clearing members with profit positions during the same day.

[23] Conversely, it may also be because the collateral a clearing member has posted as margins have lost too much value (above a certain haircut).

It is important to note that ITD margin calls are an important part of a CCP's risk management. However, in times of market stress, they can also contribute to increased liquidity risks for clearing members who have not taken them into account, not least because an ITD margin call usually has to be met within a few hours and cash may be the most practical means of meeting the requirement in time.[24]

3.4 Clearing members transfer CCPs' margin requirements to their clients

CCPs calculate and issue margin requirements for their clearing members that in turn need to meet the requirements with margins. As CCP clearing members are often larger banks, other types of market participants clear their derivative transactions indirectly via a clearing member, typically a bank (see the box "What does clearing a derivative contract at a CCP entail?" in Chapter 1). This is known as traditional client clearing. Examples of market participants include funds, pension and insurance companies, non-financial companies and smaller banks.

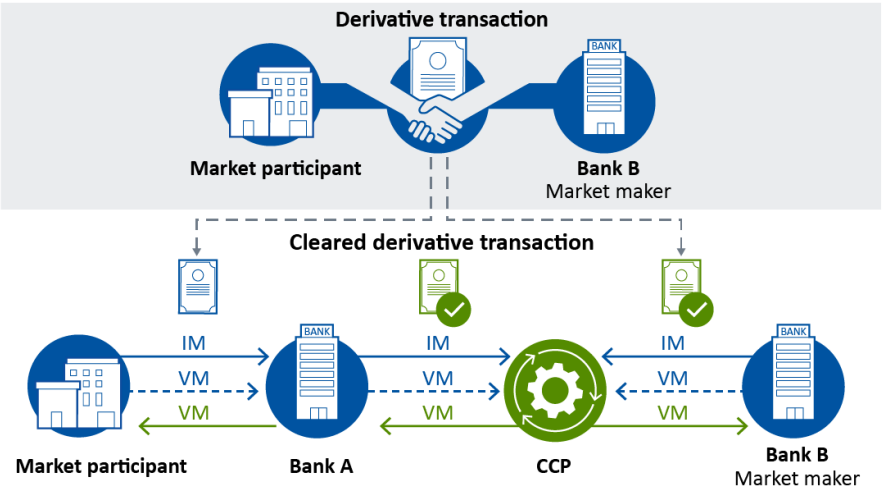
Such a market participant therefore needs to become a client of a clearing member offering client clearing services. These members thus act as agents and clear their clients' derivative transactions with the CCP. Normally, the clearing member will then be legally obliged to meet margin requirements vis-à-vis the CCP, which links to the clients' positions and may therefore incur credit losses if a client defaults.[25] For this reason, the clearing member in turn passes on the CCPs' margin requirements to its clients and the clients provide collateral to the clearing member (see Figure 7Figure 7Figure 7). Specifically, clients have an agreement with the clearing member and therefore post margins to it and not to the CCP.[26]

[24] However, some delays in meeting ITD margin calls may be allowed if the clearing member does not have obvious financial problems. For example, such delays can be explained by operational obstacles to moving collateral to the CCP quickly enough.

[25] The opposite can also be true, that is, the clearing member defaults. Under certain conditions, clients' cleared positions (held separately from those of the clearing member) can be 'ported' to another member offering client clearing. Consequently, the CCP does not have to close out these positions, which could create risks for clients, for example if they have been used for risk mitigation purposes.

[26] There are also other solutions in which clients clear their transactions directly at CCPs. These include solutions in which a client post margins directly to the CCP on the condition that it has a 'sponsor' that is a clearing member and which is responsible for matters such as making contributions to the CCP's default fund on behalf of the client. So far, however, the application of other solutions like this is limited (CPMI-IOSCO, 2022).

Figure 7. Illustration of a cleared transaction between a bank and a market participant



Note. The figure shows a transaction entered into between a market participant and a market maker (Bank B) and subsequently cleared at a CCP through traditional client clearing. The market participant is not a clearing member of the CCP and therefore clears the transaction via a clearing member offering client clearing services (Bank A). This means that the clearing member clears a matching transaction at the CCP. The market maker (Bank B) is itself a clearing member and clears directly at the CCP.

Source: The Riksbank

The margins that the clearing member require from its clients are at least at the same level as the margin requirements it has to meet itself at the CCP. Nevertheless, they may be supplemented by discretionary add-ons that depend, for example, on the clearing member's business relationship with and credit assessment of its clients (ESRB, 2020; BCBS-CPMI-IOSCO, 2025). However, this may complicate clients' liquidity planning, not least because, so far, there has been a lack of global standards and guidelines specifically for transparency in how clearing members calculate margin requirements for their clients (BCBS-CPMI-IOSCO, 2025).

FACT BOX – Large increase in margin requirements for Nasdaq Clearing's members during the 2022 energy crisis

Russia's invasion of Ukraine in February 2022 triggered an energy crisis characterised by increased volatility and soaring energy and commodity prices. This led to a large and rapid increase in margin requirements with elements of negative price spirals according to Figure 2 (ESRB, 2024b). Increased margin requirements also characterised the Nordic power derivatives market Nasdaq Commodities, which is cleared by Nasdaq Clearing.[27] Nasdaq Commodities is a regulated marketplace for trading in financial power derivative contracts. Power derivative contracts can be traded for speculation but the majority of contracts are used to hedge the price of future purchases and sales on Nord Pool, the Nordic electricity exchange for physical electricity trading.[28]

The trend of higher prices for Nordic power derivatives accelerated during the summer of 2022 as a consequence of the halted Russian gas supplies to Europe. The sharp increase in prices, along with the increased volatility, resulted in a large increase in margin requirements in the form of both VM and IM requirements for clearing members at the CCP's commodities clearing service.[29] The increase in IM requirements was due to the fact that Nasdaq Clearing uses a SPAN model to calculate IM requirements on positions in power derivative contracts. In short, this means that IM requirements on several types of power derivative contracts are determined as a statistically estimated percentage (volatility) multiplied by the prevailing power derivative price (EUR/MWh) and the size of the contract (a given number of MWh). All in all, this led to an increase in margin requirements following rising price levels.

Figure 8 shows the price developments of the power derivatives that typically have the greatest impact on clearing members' IM requirements, while Figure 9 shows clearing members' VM requirements (only those with loss positions). Figure 10 shows clearing members' ITD margin calls, as the increases in IM and VM requirements were often rapid and large. All figures also show margin requirements for clearing members in Nasdaq Clearing's financial clearing service (where equity and interest rate derivatives as well as repos are cleared), to shed light on how strong the increase actually was. This was particularly true in relation to the turbulence in financial markets in March 2020, which affected the financial clearing service.

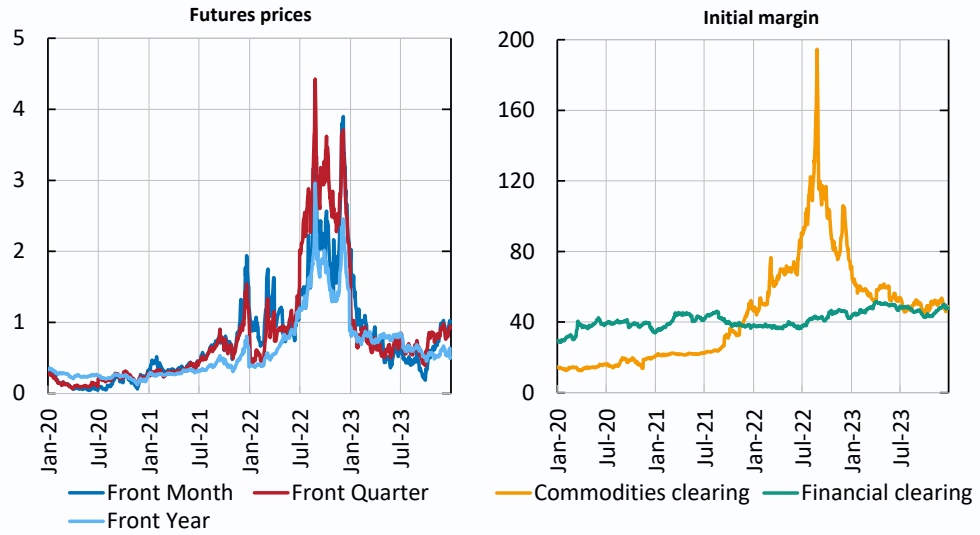
[27] Nasdaq plans to exit its commodities business; see Nasdaq (2025).

[28] For example, it is common for electricity producers and electricity trading companies active in the physical electricity market to hedge their future purchases or sales of physical electricity on Nord Pool to create better predictability in their cash flows. This can be done in order to plan investments as well as to manage risks associated with customers who have fixed electricity price contracts.

[29] It is almost exclusively Nordic power derivatives that are cleared on Nasdaq Clearing's commodities clearing service.

Figure 8. Nordic power futures prices and total IM requirements at Nasdaq Clearing

SEK thousand/MWh, SEK billion

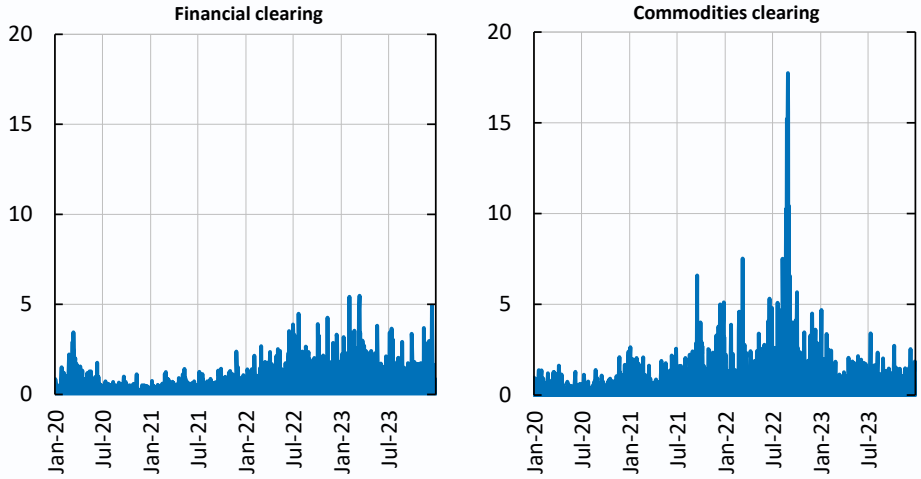


Note. The figure on the left shows rolling prices of Nordic power futures contracts for the front month (Front Month), quarter (Front Quarter) and year (Front Year), which are normally the most cleared. Changes in their market prices therefore have a major impact on the size of IM requirements. The figure on the right shows the total value of clearing members' respective IM requirements at Nasdaq Clearing's commodities clearing (including seafood clearing) and financial clearing services.

Source: The Riksbank, Macrobond and Nasdaq Clearing

Figure 9. Total (negative) VM requirements at Nasdaq Clearing per day

SEK billion

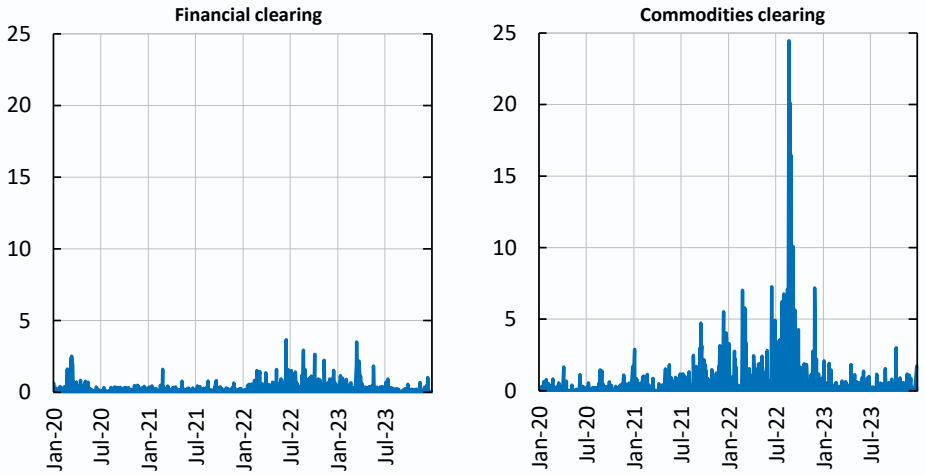


Note. The figures show the total value of negative VM requirements issued by Nasdaq Clearing to its clearing members per day that must be met with cash. The VM requirement represents the position loss made between the two previous trading days.

Sources: The Riksbank and Nasdaq Clearing

Figure 10. Total ITD margin calls at Nasdaq Clearing per day

SEK billion



Note. The figures show the total value of intraday (ITD) margin calls issued by Nasdaq Clearing to its clearing members per day.

Sources: The Riksbank and Nasdaq Clearing

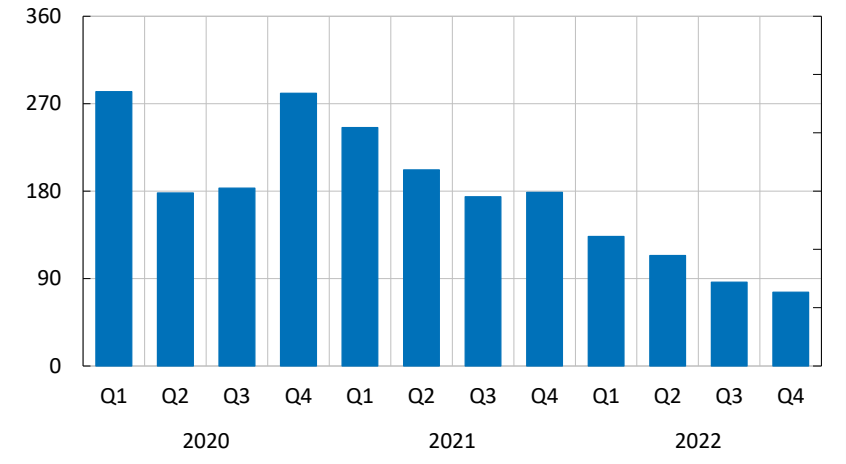
Margin requirements increased both in terms of VM and IM, putting liquidity pressure on clearing members who were forced to post more and more margins to the CCP over time, not least because many of the clearing members at the commodities clearing service are non-financial corporations who may have less liquid assets than financial corporations. In particular, clearing members who are electricity producers were affected by the large VM requirements and the rapidly increasing IM requirements.[30] The increases in IM requirements could be partially mitigated with APC tools but they could not fully absorb the increases given the extreme changes in market prices that occurred, not least because the changes can be seen as far beyond the normal stressed market conditions for which IM models are supposed to account.

One clear development observed was that Nasdaq Clearing members reduced their trading in power derivatives on Nasdaq Commodities as margin requirements increased. Figure 11 shows how the amount of cleared TWh in Nordic power derivatives decreased at the CCPs in line with increasingly higher power futures prices in autumn 2021. This was the case as margin requirements also increased as a result of the higher futures prices. It should thus be noted that margin requirements increased despite the fact that the volume of cleared power derivatives contracts steadily decreased.

[30] One source of the electricity producers' liquidity problems was the mismatch in cash flows. This was because they were forced to make large VM payments on positions in power derivative contracts used to hedge future sales of generated electricity on the physical electricity market (so-called delivery period). As the revenues from the sale are received in the future, they could not offset the need for liquidity to meet VM payments in the present.

Figure 11. Amount of Nordic power derivatives cleared at Nasdaq Clearing per quarter

Twh



Note. Power derivatives contracts have a base of 1 MW. The size of a contract (the amount of electricity in MWh) depends on the length of the period to be hedged. For example, if an electricity producer needs to hedge the price of electricity sales in a given week in the future, it can enter into a futures contract with a size of 168 MWh for that week (1 MW x 24 h x 7 days). The figure shows the total amount of Nordic power derivatives cleared at the CCP per quarter.

Sources: Nasdaq Clearing

The reduced trading meant that electricity producers either reduced the degree of hedging with power derivatives or switched to hedging via trading in power derivatives in the non-centrally cleared OTC market (Finansinspektionen, 2023). In simple terms, this is because non-financial corporations have greater opportunities than financial corporations to avoid the requirements to exchange margins in non-centrally cleared derivatives transactions. This is provided that they are entered into for risk mitigation purposes, a practice known as the so-called hedging exemption.[31] This is an important but notable contrast, as it means that there is not the same kind of potential liquidity problem as when power derivatives are cleared at a CCP. However, this comes with two major drawbacks. First, derivative transactions that take place OTC entail less transparency as well as less efficient price discovery, as Levander et al. (2021) point out. Second, there is a much higher counterparty risk between the counterparties to the transactions as well as contagion risks as they are not cleared at a CCP.

[31] This means that non-financial companies entering into OTC derivatives transactions for the purpose of mitigating business risks do not need to exchange margins with each other and can thus avoid the liquidity problems that might arise in centrally cleared derivatives transactions before purchases or sales of physical electricity have started.

Furthermore, the CCP could have incurred significant losses in the event of one or more clearing member defaults. This was because margin requirements were already at record levels from a historical perspective and because it was a potentially difficult task for the CCP to close out a defaulted clearing member's positions in a market with poor liquidity.

There was also a risk at the time that prices would rise further if clearing members were forced to enter into opposite positions to close out their positions, as there was a risk that their liquid assets would dry up. This would however put further upward pressure on power derivative prices and contribute to a self-reinforcing negative price spiral as Figure 2 illustrates. If Nasdaq Clearing would have problems managing losses in the event of a default and, in a worst-case scenario, fail itself, this could have affected financial stability. This is because the CCP offers a financial clearing service, in which banks are clearing members. Contagion effects between the power derivatives market and financial markets therefore had the potential to be so large that they could have affected financial stability.

In early September, the Government decided to instruct the Swedish National Debt Office to issue state credit guarantees for bank loans to solvent electricity producers. The aim was to prevent electricity producers from experiencing liquidity problems if the margin requirements continued to increase. This could ultimately have affected financial stability. The guarantee framework amounted to SEK 250 billion (Swedish National Debt Office, 2022).

Later in September, the market stabilised, while prices and margin requirements fell back to lower levels. However, it should be noted that no clearing member defaults occurred at Nasdaq Clearing despite the soaring margin requirements in this episode of market stress. Moreover, the credit guarantees were never utilised by any electricity producers, probably because the margin requirements were falling as a result of the slowdown in the development of power derivative prices.

4 Proposed policy measures to mitigate liquidity risks

Several episodes of market stress have led to large increases in margin requirements, both in terms of VM and IM. While the increased requirements have led to lower counterparty risks for CCPs, this has also led to increased liquidity risks for market participants, for example as supported by the BCBS-CPMI-IOSCO (2022) analysis of the market turmoil in March 2020. This analysis found that, while increased central clearing and the use of margins reduced counterparty risks during this episode, there are several areas for improvement when it comes to reducing liquidity risks. The BCBS-CPMI-IOSCO (2022) analysis, together with the subsequent BCBS-CPMI-IOSCO (2023) analysis of the 2022 energy crisis, resulted in several reports. These contained proposals for policy action addressed to CCPs and market participants, with the aim of reducing liquidity risks associated with margin requirements.

In particular, BCBS-CPMI-IOSCO (2025) has proposed concrete policy measures to improve the transparency of CCPs' and clearing members' (those offering client clearing) IM requirement calculations. The policy measures aim to increase the predictability of how requirements may increase under market stress. The measures also target the discretionary add-ons that both CCPs and clearing members add to the IM requirements they impose on their clearing members and clients respectively. It should be noted that the levels of IM requirements themselves have not been the subject of discussion; instead the focus has been on transparency in their calculation.

In addition, CPMI-IOSCO (2024) has also published a report with examples of how CCPs (and clearing members) can apply VM effectively, thereby promoting market participants' preparedness to meet with ITD margin calls driven by VM.

Furthermore, the FSB (2024) has published recommendations on how to improve the liquidity preparedness of market participants, not least because increased VM requirements are a direct consequence of, and in practice inevitable in the context of, increased market stress. The FSB's recommendations are also designed in light of the risks of self-reinforcing price spirals (see Figure 2). The recommendations are addressed to non-banks, which according to BCBS-CPMI-IOSCO (2022), were hit harder than banks in March 2020, and to non-financial companies considering the 2022 energy crisis. Non-banks and non-financial companies were the most affected by increased margin requirements in the aforementioned episodes of market stress. Market participants that are usually also clients and thus post margins to clearing members that are typically banks (although there are exceptions, such as non-financial clearing members of Nasdaq Clearing's commodities clearing service).

The ambition is that these policy proposals and recommendations at global level will contribute to improved market practices and influence relevant legislation in different jurisdictions around the world. This may help to ensure that future episodes of market stress and large increases in margin requirements do not pose as much liquidity risk in the future.

5 Concluding comments

Since the global financial crisis, the increased use of margins has led to a more prudent management of counterparty risks, both in centrally and non-centrally cleared markets. All else being equal, these developments have reduced the likelihood of market participants in the financial system incurring large losses in derivative contracts they have entered into, in the event of the default of one or more participants. In combination with central clearing, it also reduces the risk of contagion in the financial system.

A number of episodes of market stress since 2020 have forced market participants to post large amounts of cash and liquid securities as margins to CCPs to cover increased counterparty risks. This has meant, on the one hand, that CCPs would have had more prefunded resources available to absorb potential default losses. On the other hand, it has shown that market participants have been exposed to greater liquidity risks, which in itself can lead to clearing member defaults or client insolvencies. This is also the reason several recommendations and policy proposals have been put forward by the BCBS, the CPMI, IOSCO and the FSB, among others, with the aim of increasing both the transparency of and the predictability in the calculation of margin requirements, as well as increasing the liquidity preparedness of market participants. These are important aspects of safeguarding financial stability, not least because, in the wake of the global financial crisis, there has been a greater focus on managing and analysing counterparty rather than liquidity risks (Cont, 2017).

These episodes have highlighted vulnerabilities in the financial system, not least in Sweden, where clearing members at Nasdaq Clearing proved able to handle large increases in margin requirements during the 2022 energy crisis but, at the same time, had a strained situation. Note that most of these clearing members are non-financial companies, which may have less liquid assets than financial corporations. There were, however, signs of weakness that eventually led the government to decide on liquidity support measures to safeguard financial stability (see the box “Large increase in margin requirements for Nasdaq Clearing members during the 2022 energy crisis”). This is a measure that should not normally be needed. However, these episodes have created an increased awareness among both market participants and authorities that margin requirements are associated with liquidity risks. As a result, market participants and CCPs, as well as public authorities, are now better prepared to manage large increases in margin requirements. Overall, the Swedish financial system is now more resilient to increased margin requirements than previously.

Another aspect contributing to resilience in Sweden is the deposit and lending facilities that the Riksbank started offering to CCPs in autumn 2023 (Sveriges Riksbank, 2023). The availability of these overnight facilities reduces the risk of CCPs experiencing liquidity problems and being forced to sell a large amount of margins in the form of securities at an undervaluation or at falling prices in order to cover losses quickly in the event of a clearing member default. This is something that could disrupt interest rate setting in the fixed income market as well as financial stability.

However, as argued by Cont (2017), it is important that market participants and CCPs place a strong focus on liquidity risks associated with margins in their risk analyses going forward. It is therefore important that the global recommendations and proposals for policy measures are implemented, not least in Sweden where developments reflect global trends. Indeed, episodes of market stress have become more common and it is not unlikely that they will become a more frequent phenomenon in the future. This should be seen in the light of a more uncertain geopolitical and macroeconomic landscape. The market turbulence that followed the US announcement in April 2025 to impose trade tariffs on the rest of the world is a case in point.

Derivatives markets today are better equipped to face both counterparty and liquidity risks, should new episodes of extreme market stress occur in the future, at the same time as there is room for improvement. It is therefore important that derivatives markets are cleared by CCPs, that there is transparency in how margin requirements are calculated and that the liquidity preparedness of market participants is robust.

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APPENDIX - Example calculations with an equity futures position

Variation margin

A market participant takes a long position in a futures contract on 2 January 2026 and commits to buy 100 XYZ shares at SEK 100 per share on the expiration day of 30 January 2026.[32] The futures contract is traded in a futures market and cleared at a CCP. Until the expiration day, variation margin (VM) will be exchanged between the participant and the CCP.

The next day, 3 January, the closing price of the future is SEK 110. The market price increase of SEK 10 benefits the participant, as the futures market is pricing that the spot price of the XYZ stock will be higher than SEK 100 on 31 January (the participant can buy the shares cheaper via the futures contract than via the spot market). This means that the participant has made a position profit in the form of VM and, on 4 January, will receive SEK 10/share x 100 shares = SEK 1,000 from the CCP.

On 4 January, the closing price of the future is instead SEK 105. The market price fall of SEK 5 is unfavourable this time. This means that the participant has made a position loss and, on 5 January, must pay the VM of SEK 5/share x 100 shares = SEK 500 to the CCP.

The exchange of VMs will continue in the same way until the expiration day when the participant will purchase the 100 XYZ shares. If the participant has made an cumulated position profit (in the form of VM) on 30 January, the profit corresponds to the amount of money the participant saved by buying the shares via the futures contract instead of directly on the spot market on this date. The opposite is true for a cumulated position loss.

The market participant will also have to meet an IM requirement on the position until the expiration day. A conceptual, but simplified, example of an IM calculation is described in the next section.

[32] In this example, XYZ is a fictitious company that is assumed to be listed on a stock exchange.

Initial margin

The CCP uses a simple statistical model with Value at Risk (VaR) to calculate initial margin (IM). The model uses a two-day margin period of risk (MPOR), a 99 per cent confidence level and a lookback period of 252 trading days (one year).

The most recent 252 percentage market price changes (returns) that have occurred over two consecutive trading days in the price of the XYZ futures are summarised.[33] The futures price of SEK 100/share is multiplied by each percentage market price change and the size of the contract (100 shares) to create 252 scenarios of daily value changes in the futures position. A distribution of these value changes (P&L distribution) is constructed, that is a sorted series from the largest loss (smallest negative change in value) to the largest profit (largest positive change in value). In this case, VaR, with the given confidence level, will be the fourth smallest daily value change in the series. This is because 99 per cent of all value changes result in smaller losses (larger profits). This value thus reflects the volatility of the lookback period. For the IM requirement to reflect two days in accordance with MPOR, the selected value change is scaled up by the root of two according to the square root of time rule.[34]

Assuming that a daily market price change of -12 per cent in the future price gives rise to the selected daily position value change, the IM requirement on 2 January 2026 would be

$$\text{IM requirement} = \sqrt{2} \cdot \text{VaR}_{99\,\%}(\text{P\&L distribution}) \approx$$

$$\sqrt{2} \cdot -12\,\% \cdot \text{SEK } 100\ /\text{share} \cdot 100\ \text{shares} \approx \text{SEK} - 1{,}700.$$

The participant will need to post collateral to the CCP with a value that is at least equivalent to the SEK 1,700 requirement at the time when the future is cleared. Since a future is a linear derivative contract (its value changes one-to-one with the price of the underlying asset), we can in this example interpret the calculated IM requirement as that the CCP could incur losses of SEK 1,700 in the form of VM if the market participant defaults and the futures price of the XYZ stock falls by $\sqrt{2} \cdot -12\,\% \approx -17\,\%$ over two consecutive days from the level of SEK 100/share.

The next day, 3 January, the IM requirement may change due to a change in volatility, an increase in the futures price or a combination of the two. Assuming that the IM requirement has increased to SEK 2,000 on this day, the participant must post additional collateral equivalent to SEK 300 because it already has collateral posted at the CCP to a value of SEK 1,700. By 4 January, the requirement may have fallen to SEK 1,900 and the participant may hence withdraw SEK 100 of the collateral it has posted at the CCP.

The IM requirement remains and is adjusted in the same way until the expiration day or until the participant closes out the position prematurely. The participant can then

[33] Please note that the futures price is the underlying asset in this example and that this is for illustrative purposes only.

[34] It is common for models to apply this rule (Gurrola-Perez & Murphy 2015). The models are therefore based on a simplified assumption that the value changes are random variables that are independent normally distributed.

withdraw all collateral currently posted at the CCP (assuming that it only had this position cleared).

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