

Eurex Clearing Prisma

Portfolio-based risk management

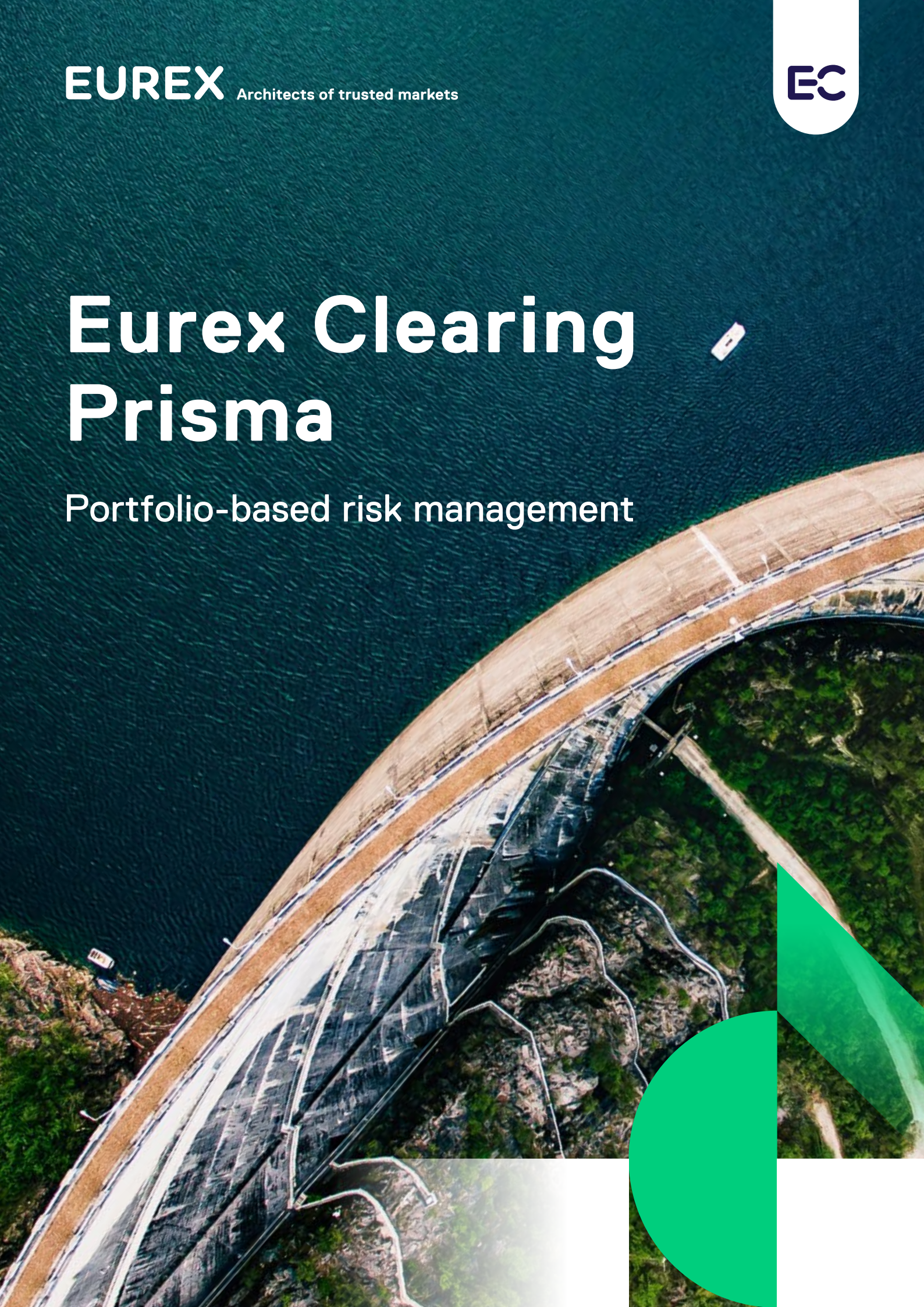


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Eurex Clearing Prisma: Delivering innovation with portfolio-based risk management

Eurex Clearing is a leader in clearing technology and state-of-the-art customer solutions. It was first to introduce both real-time risk calculation and real-time risk-data provision. Moreover, Eurex Clearing continues to set industry standards in risk management.

With its portfolio-based risk management approach – Eurex Clearing Prisma – Eurex Clearing offers an innovative way to help customers maximize collateral efficiency.

Eurex Clearing Prisma was developed in close harmony with customers worldwide to enable maximum benefits and ensure regulatory compliance for all market participants. Furthermore, it maintains reliable counter-cyclical margin levels in even the most challenging situations by utilizing a transparent and risk-sensitive methodology.

Eurex Clearing Prisma helps clients unlock margin efficiency by recognizing risk offsets across **listed derivatives, OTC derivatives and fixed income securities**. Through comprehensive portfolio margining and **cross-margining between listed and OTC interest rate derivatives**, clients can benefit from reduced margin requirements while retaining the highest standards of risk management.

The flexible framework also supports the introduction of new products and services, creating additional opportunities to optimize collateral and capital usage. Backed by the robustness, reliability and integrity of Eurex Clearing, Prisma delivers a market-leading solution for efficient portfolio-based risk management.

In addition to delivering synergies by reflecting risk netting effects, Prisma also provides cross-margining benefits between listed derivatives and OTC IRS positions. It also provides flexibility when introducing new products and opportunities while enhancing collateral and capital efficiency. Eurex Clearing Prisma offers all this with the robustness

and reliability the market expects. It is a solution providing safety, efficiency, and integrity.

Eurex Clearing Prisma calculates risks across all derivatives markets as well as fixed income securities for selected issuers as announced via circular on www.eurex.com cleared by Eurex Clearing. Cleared products with similar risk characteristics and aligned default management processes are assigned to the same liquidation group and splits therein, resulting in more comprehensive risk calculations and enabling portfolio margining across positions within a split and cross margining across splits within a liquidation group. Eurex Clearing optimizes post-trade activity for all market participants – better preparing clients for new regulations so they can respond promptly to challenging market conditions and feel confident they are clear to trade.

About Eurex Clearing

Eurex Clearing is a leading global central counterparty – assuring the safety and integrity of markets while providing innovation in risk management, clearing technology and client asset protection. Eurex Clearing clears the broadest scope of products under a single framework in Europe and offers the world's broadest spectrum of eligible collateral.

www.eurexclearing.com

Introduction to Eurex Clearing Prisma

Eurex Clearing's Prisma methodology¹ features concepts building on existing principles and procedures to achieve enhanced precision and maximize the use of collateral. This section begins by explaining liquidation groups and splits, detailing key elements of the portfolio-based margining system which enable Eurex Clearing to deliver synergies such as portfolio and cross margining. This explanation is then followed by a description explaining how the default management process is designed to accommodate the concept of liquidation groups. In a subsequent section, the brochure explains the margin calculation method.

Liquidation Groups and Splits

A clearing member's portfolio typically features a heterogeneous structure, size and/or complexity. Given this complexity and the general handling principles laid out in Eurex Clearing's default management process, it is usually impossible to liquidate an entire portfolio in a single transaction.

Therefore, Eurex Clearing has introduced the concept of liquidation groups and splits and calculates risk at those levels. Cleared products with similar risk characteristics are generally assigned to the same liquidation group and specifically to splits therein carrying, amongst others, information about the margin period of risk (MPOR). Provided that offsets can be realized during the default management process, this

structure allows for a more comprehensive portfolio risk calculation within a split and ultimately enables cross margining across liquidation group splits. With this process, Eurex Clearing Prisma closely aligns the margining methodology with the default management process.

A complete liquidation group split can be hedged by Eurex Clearing, priced by clearing members, and consequently auctioned within a reasonable time frame.

General principles for liquidation groups and splits:

- Portfolio margin offsets are only granted within pre-defined liquidation groups and splits.
- Each liquidation group split has a dedicated, fixed margin period of risk reflecting the time estimated to analyze, hedge, and liquidate the respective positions. The margin period of risk ranges between two to five days and is the basis for the margin calculation.

The list of current liquidation groups and splits and their margin period of risk are listed in the table below. Multiple splits per group currently only exist for the Fixed Income and OTC liquidation group. Which instruments are assigned to which group is listed on the Eurex Clearing website:

[Risk Parameters](#).

¹ Please visit the Eurex Clearing Prisma User Guide, available on the Member Section, for more detailed information on specific topics.

Table 1: Liquidation Groups & Splits and MPOR

Liquidation Group and Splits		MPOR (days)
PEQ01	Listed Equity (Index) Derivatives	3
PFI01	Fixed Income and FX Liquidation Group	
	Fixed Income Securities	2
	Fixed Income and Foreign Exchange Derivatives	2
	OTC Interest Rate Derivatives	5
PNF01	Non-Deliverable Forwards	5
PCM01	Commodity (Index) Derivatives	3
PPM01	Precious Metal Derivatives	3
PEF01	Derivatives on Fixed Income ETFs	2
PCY01	Crypto Derivatives	3

Default management

As one of the world's leading clearing houses, Eurex Clearing plays a vital role in the global effort to maintain stability in financial markets. Eurex Clearing recognizes its responsibility to help mitigate systemic risks should the default of a clearing member occur. With all past default events, Eurex Clearing successfully liquidated the defaulted clearing member's portfolio within the defaulter's resources. It was mainly thanks to the robust procedures that Eurex Clearing had in place in dealing with a clearing member default that Eurex Clearing was prepared to act when the need arose. Eurex Clearing maintains its readiness to act by continuously updating its safeguards and introducing innovative product offerings that optimize the clients' safety as well as protect the clearing house.

Default procedures

Aware that each default scenario is unique, Eurex Clearing maintains flexibility in its procedures to accommodate the individual features of each default. The procedures provide a transparent and adjustable framework that is applied depending on the circumstances of the scenario at hand and consistent with local and global regulatory standards.

The default management process is designed to enable Eurex Clearing to individually handle portfolios in various liquidation groups. As it is expected that the liquidation for different liquidation groups is likely to be conducted overlapping in time, the concrete measures applied can vary. Despite the individual nature of every situation, explicit trigger events for a clearing member's default have been defined, regardless of the product or cleared market. If a clearing member has been declared to be in default, the clearing member's proprietary positions and its client positions may be treated differently.

Client positions

When a clearing member defaults, one of Eurex Clearing's principal objectives is protecting customers and minimizing the impact on clients and their positions. Eurex Clearing is committed to ensuring that clients and their positions can be transferred to a new, solvent clearing member quickly and smoothly, wherever possible.

The risk management and clearing procedures have proven to be robust, even in times of acute distress in financial markets. Clients have access to a broad range of segregation types, offering various degrees of asset protection and portability. Highly segregated Clearing Models, client preparedness and multiple clearing relationships foster a high porting likelihood.

Figure 1: Default Management Process



Default management process

Eurex Clearing's default management process is a set of procedures designed to facilitate the orderly liquidation of even the largest and most complex portfolios.

The following briefly describes key components of the default management process:

- **Default Management Committees:** Default Management Committees (DMCs) advise and assist the clearing house concerning any relevant matter of the default management process, most importantly, hedging the portfolio and preparation of auctions. Each DMC is staffed with professional employees of preselected clearing members. They have sufficient trading and risk expertise in the products belonging to the respective liquidation group(s) for which the Default Management Committee is convened. Default Management Committees will be convened in the event of a clearing member default in addition to regular default simulations (at least once per year).
- **Hedging:** The purpose of hedging within the default management process is to enable Eurex Clearing to reduce market and potential cash-flow risks. Furthermore, hedging reduces the portfolio's sensitivity to market moves and stabilizes it for auctions. Hedging can be executed with independent trades or in a Mandatory Hedging Auction.

- **Independent sale:** In granting sufficient flexibility during a default situation, positions or groups of positions can be sold independently to individual members, i.e., positions of the defaulted clearing member are reestablished by the clearing house either on-exchange or OTC as an alternative to the auction process.

- **Auction process:** The liquidation group-specific auction process is the main component of the default management process. An auction enables Eurex Clearing to rapidly transfer risk in bulk to willing absorbers, establishing fair market prices for the respective portfolios.

Lines of defense

When a default occurs, Eurex Clearing becomes liable for all the payments relating to any contract entered into by the defaulted party. Additionally, Eurex Clearing may face losses when entering into hedging or replacement transactions. These losses are born by the "lines of defense." While the mainstay of this safety system is the margin that clearing members have deposited as collateral for open positions, these lines of defense consist of several additional layers of financial resources, namely:

- The defaulted clearing member's Default Fund contribution
- Eurex Clearing's own resources (prefunded dedicated amount)

- Default Fund contributions of all other non-defaulted clearing members (prefunded)
- Eurex Clearing's further own resources (prefunded 2nd dedicated amount)
- Further contributions of Eurex Clearing and the non-defaulted clearing members (not prefunded assessment of the Default Fund, aka Recovery Cash Calls)

Segmented Default Fund

Eurex Clearing maintains a segmented Default Fund, consisting of multiple liquidation group-specific Default Fund segments (DFS). The sum of all DFSs is the overall Default Fund.

The segmentation of the Default Fund ensures that the contributions used first are from those clearing members' who have been active in the liquidation group(s) where losses arise. Meanwhile, the segmentation still maintains the capital

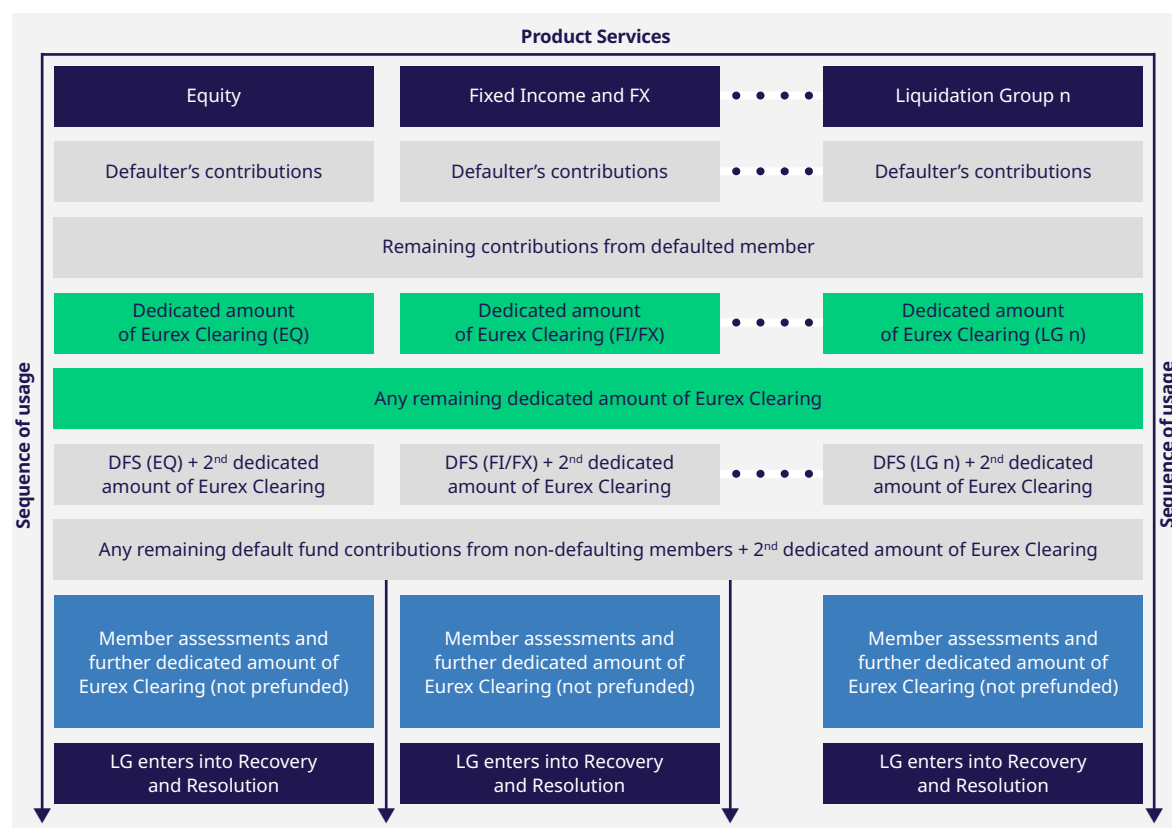
efficiencies of one joint Default Fund compared to multiple asset class-specific Default Funds.

Assessments

Eurex Clearing ensures that the liability of a clearing member towards the clearing house is limited. As such, Eurex Clearing's right to assess the Default Fund, i.e., Eurex Clearing's right to request clearing members to replenish their Default Fund contributions once utilized, is capped. In any crisis, each clearing member is only obliged to provide additional funds, up to two times its pre-funded Default Fund segment(s), corresponding to the asset class(es) driving the excess losses.

In the event of a default, defense layers are applied in the order illustrated in Figure 2. These lines of defense are designed to help protect the marketplace and play a key role in preventing a domino effect.

Figure 2: Lines of defense – sequence of usage by Liquidation Group



Margin components

Margin requirements aim to cover potential losses arising from liquidating a defaulted clearing member's portfolio. According to the „defaulter pays“ scheme, margins should be sufficient to cover the losses also in unfavorable market conditions and need to cover two components:

- Mark-to-market margin (backward-looking margin components)
- Initial margin (forward-looking margin components)

Backward and forward-looking margin components are depicted in Figure 3 and described in detail in this section. After providing an in-depth discussion of each margin component, the aggregation of the different forward-looking components into initial margin requirement of each clearing member is described.

Backward-looking components: mark-to-market margin

Eurex Clearing Prisma considers product-specific backward-looking margin components: a premium margin, which allows for the deposit of collateral; a variation margin (including price alignment interest for OTC trades) calculated daily to exchange profits and losses, which needs to be deposited in cash; and Current Liquidating Margin (CLM), used for fixed income transactions.

Premium margin

The seller of an option must deposit a premium margin if the transaction results in an open position. It covers the potential loss incurred if the seller would be forced to liquidate the position today. The premium margin is continuously adjusted, i.e., if option prices fluctuate so that the potential loss upon liquidation increases or decreases, the seller will be obliged to deposit more [less] premium margin respectively.

Premium margin is calculated for all positions in option products that are subject to „premium-style margining.“ This involves those options for which the premium is paid in full at the time of purchase (e.g., equity options). Premium margin covers the costs or profits that would arise upon liquidating all positions of a specific product at their respective closing prices.

Current Liquidating Margin

To cover for the potential loss incurred for fixed income settlement transactions if positions were to be forcefully closed out today. The current liquidating margin is approximately the difference between the current market price and the trade price of the fixed income transaction.

Figure 3: Eurex Clearing Prisma margin components

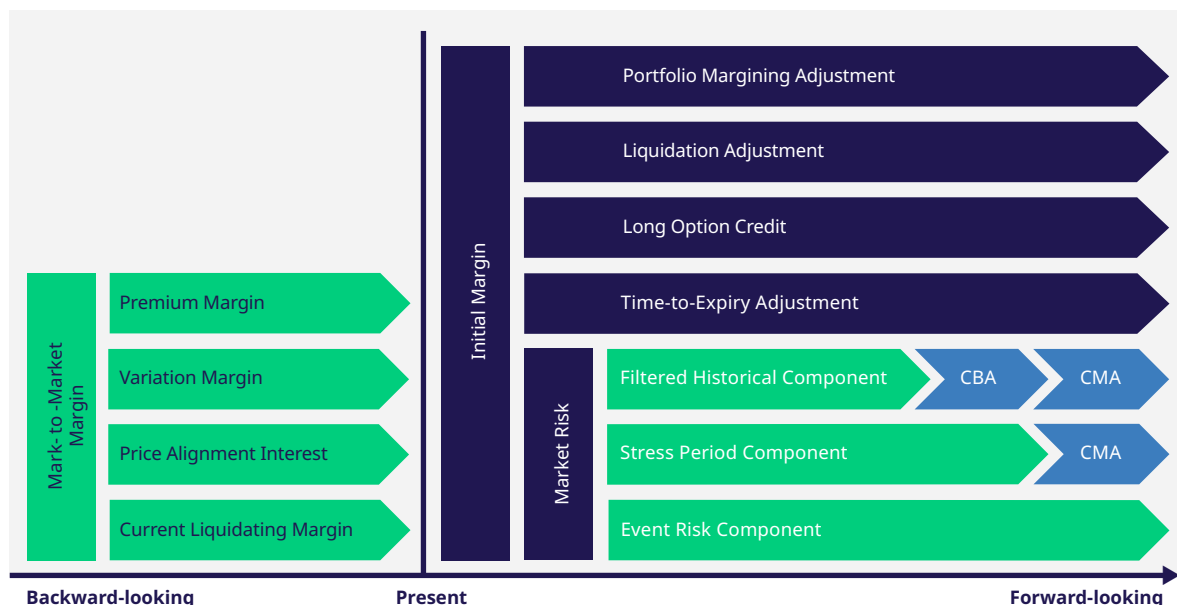
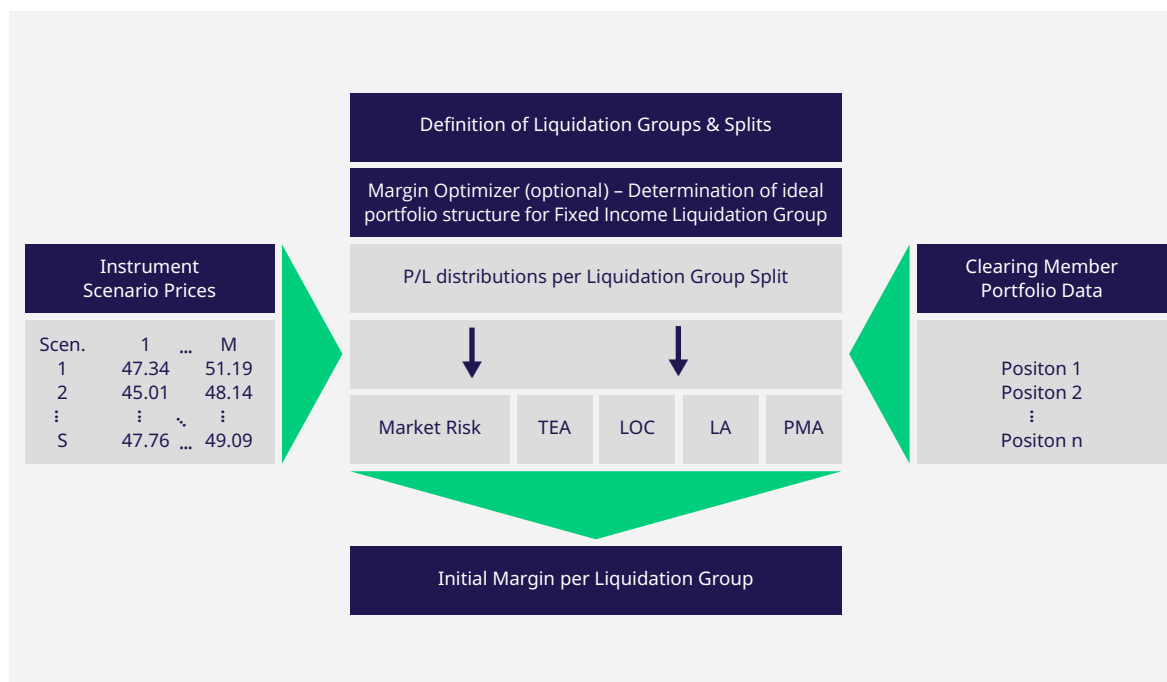


Figure 4: Methodology



Variation margin

On a mark-to-market basis, Eurex Clearing settles the trading day's profits and losses of all open positions held in a position account in cash. This approach applies to all derivatives that are subject to "futures-style margining". To exchange profits and losses arising due to price fluctuations of open positions, Eurex Clearing asks for cash collateral that is settled daily in the respective product currency, also known as variation margin.

The owner of a long position purchased at a lower price than the daily closing price (settlement price) is credited with the difference between the two prices. In contrast, the owner of the related short position must pay that difference.

Price alignment interest

Price alignment interest (PAI) serves as another cash-based margin component in addition to variation margin and is only applicable to products within Eurex Clearing's OTC derivatives offering. It minimizes the impact of daily cash variation margin payments on the pricing of OTC derivatives compared to non-cleared, i.e., without daily price alignment.

Eurex Clearing charges/pays interest using the overnight interest rate of the corresponding currency on the cumulative variation margin received/paid. The price alignment interest is applied separately to each trading currency on a portfolio basis and is settled daily, analogous to variation margin.

Forward-looking component: initial margin

The forward-looking margin is called initial margin (IM). It estimates the potential future exposure of clearing members' portfolios in alignment with the default management assumptions. More precisely, it employs the decomposition into liquidation groups and splits and also reflects the respective margin period of risk and the pre-defined confidence level. The initial margin of a clearing member's position account is aggregated across the respective liquidation group splits.

Initial margin consists of two main components:

- Market risk
- Liquidation risk

Market risk component

The market risk component targets a confidence level of 99% for fixed-income transactions and listed products and 99.5% for OTC derivatives. The pure market risk components of the model, i.e., without model adjustments, are calculated based on three scenario sets:

- **Filtered historical scenarios:** These scenarios use recent historical data scaled by current market volatility. The filtering is achieved via the use of an EWMA model for risk factor volatility forecasting, ensuring model reactivity to changing market conditions.
- **Stress period scenarios:** These unfiltered scenarios incorporate data from historical periods of significant market stress. Their inclusion is a key anti-procyclicality tool that provides a stable floor for margin, preventing margin requirements from falling to inadequate levels during periods of relative market calm.
- **Event risk scenarios:** These non-statistical set of scenarios is designed to cover idiosyncratic risks from sudden independent market events for certain types of products.

The scenario simulation is applied across a comprehensive set of risk factors that drive the valuation of cleared instruments. These include, but are not limited to, equity prices, interest rate curves, foreign exchange rates, and implied volatilities.

By modelling the behavior of these risk factors under historical and stressed conditions in a portfolio margining setup, Eurex Clearing Prisma captures not only individual instrument risk but also the correlations and diversification effects within a portfolio.

The tail risk measure Value-at-Risk is applied to the profit and loss distributions of the historical and the stress period sample. In contrast, the event risk component is assessed based on the sum of worst “n” scenario losses.

An overview of the key model parameters and components can be found in Table 2.

Table 2: Key model Parameters and Components

Component	Asset Class		
	Exchange Traded Derivatives	OTC Derivatives	Fixed Income Securities
FHS Scenarios (rolling lookback)	Three-years	Three-years	Ten-years
Target Confidence Level	99%	99.5%	99%
Anti-Procyclicality Measure	25% weighting to stressed observations	25% weighting to stressed observations	Unfiltered VaR on ten-years plus additional stress periods

All historical scenarios are updated daily with the latest risk factor and price information available, leading to a daily updating sample. Stress period and event risk scenarios are recalibrated on a predefined frequency.

Based on simulated scenario prices, scenario profit and losses for each instrument are calculated. By aggregating such scenario profit and losses in the

appropriate currency across positions allocated to liquidation group splits allows to naturally reflect risk offsetting effects within such splits.

Figure 5 illustrates the calculation and aggregation of the market risk components of a portfolio across the filtered-historical, stress period, and event risk components.

Model adjustments

In order to mitigate model risks inherent to the estimation of potential future exposure, the following model adjustments are included and accompany the pure market risk component.

Some model adjustments only apply to some types of products and might therefore only pertain to some liquidation groups splits.

- Correlation break adjustment (CBA) assesses further statistical variability within the filtered-historical component to provide a buffer against correlation breakdown. CBA is applicable to Listed and OTC Derivatives only.
- Compression model adjustment (CMA) accounts for data compression techniques applied within risk factor modeling, such as the modeling of implied volatility surfaces by a reduced set of parameters.

- Long option credit (LOC) compensates long option-dominated portfolios by providing a margin credit if initial margin exceeds premium margin.
- Time-to-Expiry adjustment (TEA) accounts for changes in the risk profile due to positions expiring or resetting of fixings during the simulated margin period of risk.
- Portfolio Margining Adjustment (PMA) aims to control the amount of netting benefits on portfolio level and to contain the extent of such offsets for certain liquidation group splits.

Liquidation risk component

The liquidation risk component is designed to capture the potential additional costs when liquidating portfolios, including possible adverse price movements. The most important characteristics are listed below:

Figure 5: Exemplary market risk calculation based on reference configuration for listed products

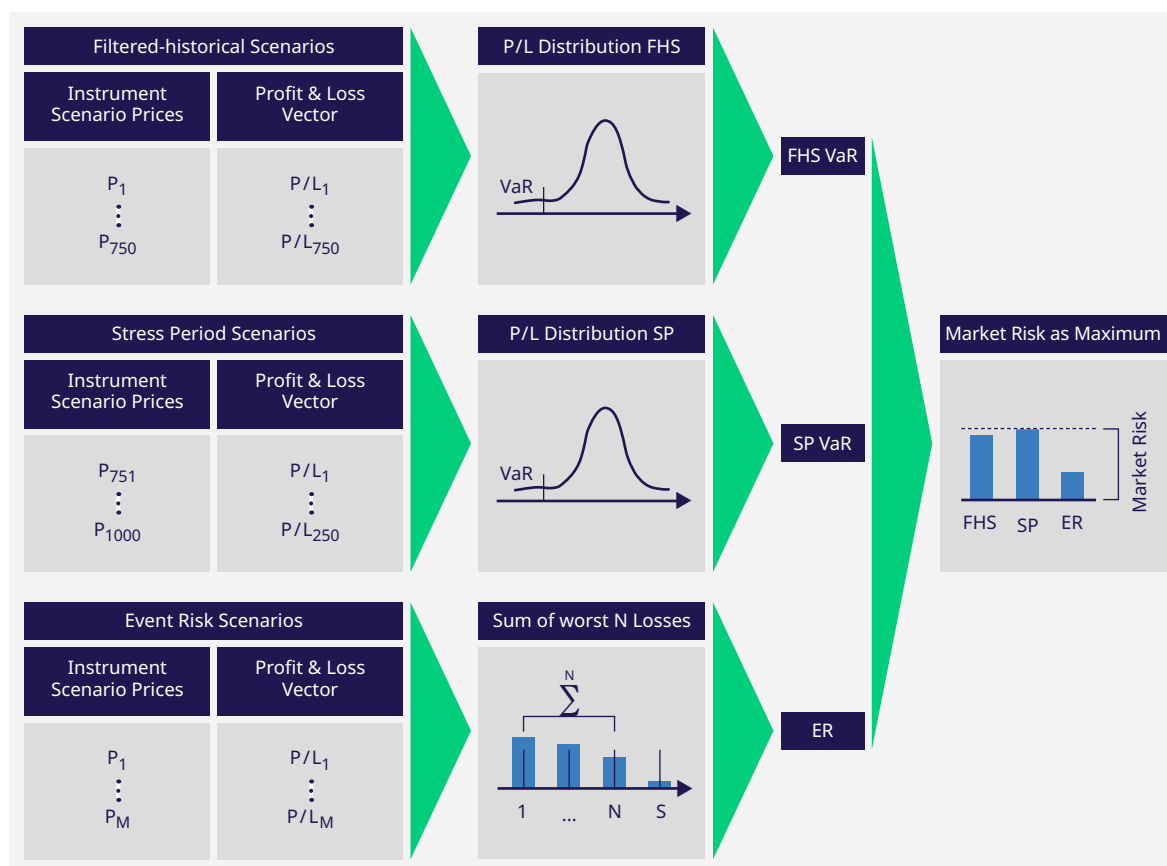
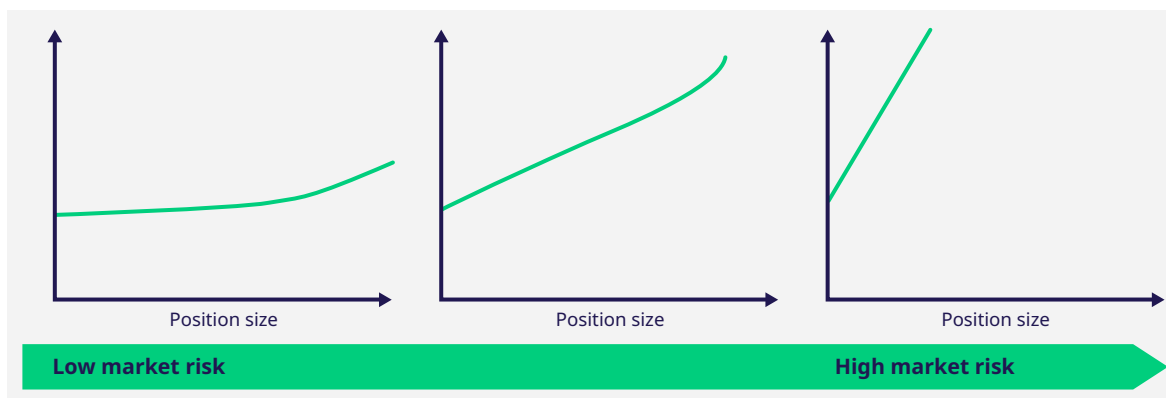


Figure 6: Liquidation risk dynamics



- The liquidation risk component is a function of the relative position size and the market capacity, which can be characterized using daily traded volume or open interest of a financial instrument.
- The liquidation risk component depends on the current level of market risk of the respective product, i.e., the higher the market risk of an instrument's price, the higher the premium.
- Market capacities and liquidation risk components are product-specific and unevenly distributed across product subgroups, i.e., for options, the market capacities depend on their moneyness and time to expiry.

Figure 6 depicts the liquidation risk component's dependence on the position size and the market risk of three positions with different risk profiles. The liquidation risk component grows with increasing position size for all three positions. It increases faster for a position carrying a higher market risk than for positions with smaller market risk.

Specific treatment for swaps products

Due to product-specific requirements and market conventions, OTC interest rate derivatives are treated differently from exchange-traded instruments. The liquidation risk component is calculated by currency according to the expected transaction costs of swaps required to hedge the clearing members' portfolio.

Aggregating forward-looking components

The total initial margin component for positions within a single liquidation group split consists of the market risk, as an aggregate over respective risk measures sets as well as respective model adjustments and the liquidation risk components.

Aggregation of market risk component

The filtered-historical and the stress period components are aggregated, including the relevant model adjustments. The resulting three values of

the filtered-historical, the stress period, and the event risk measures are thereafter aggregated by taking the maximum of all three, as depicted in Figure 5. The aggregation ensures that the filtered-historical component is floored by the stress period as well as the event risk component.

The result can naturally differ per clearing member and risk account. In one instance, it can be determined by the filtered-historical component. In another, it can be the stress period or the event risk component. The selected component is the most favorable for the safety of the clearing house and, consequently, the whole market.

Aggregation of initial margin

The initial margin per liquidation group split is determined by combining the market risk component with the remaining model adjustments and the liquidation risk component. This approach is performed for all positions of a clearing member's risk account per liquidation group split and subsequently summed to the level of the liquidation group. The consolidated initial margin for a clearing member's risk account is the sum of initial margins across liquidation groups.

Key model assumptions and limitations

The Eurex Prisma initial margin model is based on several key assumptions. The primary assumption is that a clearing member has already defaulted. Consequently, the model does not incorporate any probability of default. Within this framework, the following outlines the key assumptions and limitations of the initial margin model, the circumstances under which these assumptions are no longer valid, as well as the qualitative and quantitative impact on initial margin requirements.

Liquidation group setup / portfolio offsets

The key assumption is that the products within the

same liquidation group split are subject to aligned liquidation and within the respective liquidation period. This assumption forms the basis for the recognition of portfolio offsets across products within the same liquidation group.

The assumption may no longer hold under market conditions which prevent joint hedging and liquidation in default management process. The resulting impact on margin requirements may be both qualitative and quantitative. Specifically, positions may need to be liquidated separately, reducing or eliminating portfolio offsets and potentially leading to realized losses consistent with unaligned liquidation process.

Long-Option Credit (LOC)

A key limitation of the LOC component is that it relies on a rule-based approach which aims to characterize a portfolio as dominated by long options. The criteria are a necessary but not sufficient condition for more complex portfolios. In such exceptional cases, the LOC may not be granted

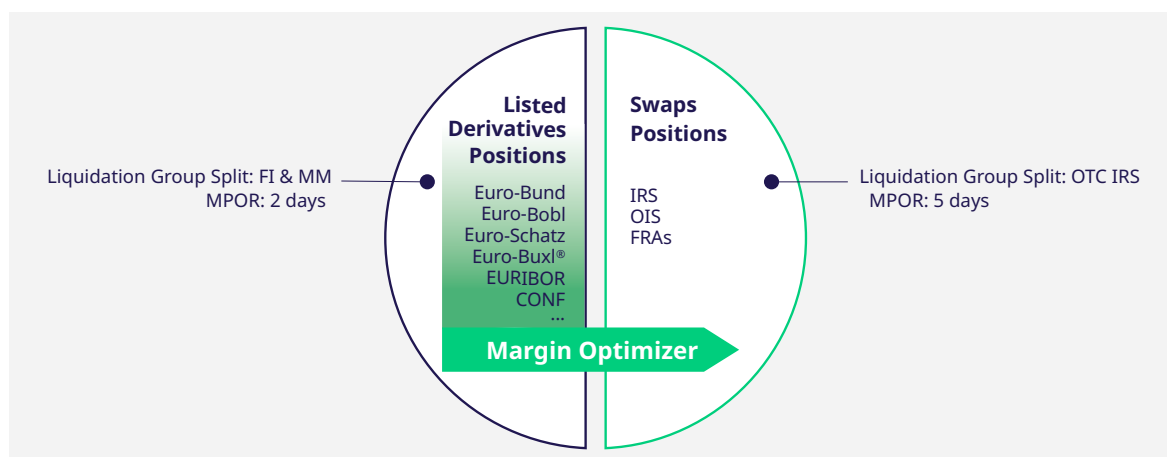
despite the portfolio having a limited maximum loss. The quantitative consequence is that the calculated initial margin requirement may exceed the portfolio's maximum potential loss.

Liquidity Adjustment (LA)

A key assumption of the LA component is that historically observed market capacities, supplemented by trader surveys, provide a reasonable proxy for liquidity conditions that may prevail during the default management process under stressed market conditions. This assumption may become invalid during periods of rapidly changing market regimes or evolving trading patterns.

In such circumstances, actual market capacity may be lower than assumed by the model, resulting in a longer liquidation horizon than anticipated. The qualitative and quantitative consequence is that the liquidation process may take more time to complete and may incur higher realized losses, reflecting the increased market impact and execution risk associated with a prolonged liquidation period.

Figure 7: Margin optimization via cross-margining



Cross-margining allocation algorithm for listed and OTC interest rate derivatives

A cross-margining allocation algorithm for fixed-income, money market and interest rate derivatives allows for capital-efficient margining.

Before calculating the individual margin components for the two liquidation group splits containing exchange-traded fixed income and money market derivatives on the one hand and OTC interest rate derivatives on the other, an optional cross-margining algorithm determines the ideal portfolio structure by combining positions in exchange-traded fixed income (e.g., Euro-Bund Futures) and money market derivatives (e.g., EURIBOR Futures) with those in

OTC interest rate derivatives (IRD) as depicted in Figure 7, thereby enabling cross-margining.

This allocation aims to reduce the interest rate sensitivities of the positions within the IRD Liquidation Group Split as far as possible.

The algorithm assigns the appropriate number of futures and/or options to maximize the offset of the IRD position.

Based on this allocation, the Margin Optimizer also ensures that no adverse effects from the increased margin period of risk occur.

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