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Abstract

Market participants exchange margins to cover counterparty and collateral risks in repo transactions. Despite their importance for risk mitigation and financial stability, evidence on margin practices is generally limited, particularly outside central clearing, with recent studies suggesting that requirements are often low in specific segments. Using transaction-level regulatory data from the Securities Financing Transactions Regulation (SFTR), this paper provides novel evidence on repo margining practices in Europe. We identify three main findings. First, margin levels vary across market segments and counterparties, with bilateral contracts generally subject to lower requirements than centrally cleared trades. Second, margins are often set at the portfolio level on a net exposure basis, with balanced positions attracting lower requirements. Third, market fluctuations strongly influence margin dynamics: centrally cleared trades are most affected by medium-term movements, whereas bilateral contracts respond more to short-term swings and exhibit nonlinear behavior in tail scenarios.

JEL Classifications: G10, G14, G20, G21, G23, G32

Keywords: repurchase agreements, margins, collateral, net exposure, central clearing, bilateral markets

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Non-technical Summary

Repurchase agreements (repos) play a pivotal role in modern financial systems. They allow market participants to secure funding, manage liquidity, and efficiently source and allocate collateral, supporting trading and post-trading activities. Repos facilitate price discovery, support settlement obligations, and enhance market efficiency and liquidity. A well-functioning repo market is vital to the daily operations of financial markets and to the broader financial stability.

Repo participants apply haircuts and exchange margins to protect themselves against counterparty and collateral risk. By creating liquidity buffers within the system, these tools help absorb shocks and enhance overall market resilience. If not properly calibrated, margins may be subject to abrupt adjustments in periods of market stress, which can heighten liquidity risks and exacerbate financial instability. Despite their role in risk mitigation, recent evidence suggests that haircuts in bilateral repos are often set at very low or zero levels, while empirical evidence on margin practices – particularly outside the centrally cleared repo segment – remains limited. The combination of low transparency and potentially lax market standards raises concerns about hidden vulnerabilities, suggesting that margin requirements may, in some cases, be insufficiently stringent and contribute to excessive leverage and risk-taking, including outside the banking sector.

Using data from the Securities Financing Transactions Regulation (SFTR), this paper provides new evidence on margining practices in the European repo market. To our knowledge, it is the first study to systematically analyse margin practices in both centrally cleared and bilateral segments, covering a diverse set of counterparties and collateral types. The main findings are as follows. First, margins levels vary significantly across market segments and counterparties, with requirements in the bilateral segment generally lower than those in centrally cleared markets – even after controlling for collateral type, counterparty characteristics, and other relevant factors. Second, margins are typically set at the portfolio level based on a net exposure basis, with more balanced positions associated with lower requirements. Third, margin requirements adjust to market volatility and tail risks, though with notable variation across segments: centrally cleared trades are more affected by medium-term fluctuations, while bilateral contracts are more sensitive to short-term movements and display nonlinear dynamics under market stress. The paper also proposes metrics to compare margin requirements across repo segments.

Overall, this analysis seeks to support ESMA's mandate of promoting orderly markets and financial stability by providing a comprehensive analysis of margin requirements across European repo market segments, including their behaviour in different market conditions.

1. Introduction

Repurchase agreements (repos) play a pivotal role in modern financial systems. They allow market participants to secure funding, manage liquidity, and efficiently source and allocate collateral, thereby supporting both trading and post-trading activities. In doing so, repos facilitate the implementation of trading strategies, strengthen price discovery, support settlement obligations, and enhance overall market efficiency, liquidity, and capital allocation. Because repo rates anchor the short end of the yield curve, the repo market is also a key channel for the effective transmission of monetary policy. A deep and well-functioning repo market is therefore vital to the day-to-day functioning of financial markets and to the broader stability of the financial system (Adrian and Shin (2010), Gorton and Metrick (2012), and Copeland et al. (2014)).

Repo markets are currently the largest segment of European money markets, having surpassed the unsecured interbank segment following the 2008 financial crisis (ECB (2022)). Recent studies estimate the size of repo activity as of end-2023 by entities domiciled in the European Economic Area (EEA) to be between EUR 6 and 7 tn, when considering total outstanding amounts (ESMA (2024) and Hermes et al. (2025)), and about EUR 1 tn when looking at volumes (ECB (2024)). In Europe, the vast majority of activity is comprised of centrally cleared and bilaterally cleared repos.[1] The former, characterised predominantly by interbank trading, accounts for the majority of trading volumes and approximately 40% of outstanding amounts (ESMA (2024)). The latter - i.e. bilateral repo - is estimated to represent 30% of trading volumes and more than half of the total outstanding amounts (Bassi et al. (2024)). Bilateral repo is also characterised by a variety of market participants and represents the most common way to access the repo market for non-bank investors, which generally trade with intermediaries.[2] Counterparties with significant securities portfolios, such as asset managers and pension funds, typically lend these assets to enhance returns and manage liquidity, receiving cash as collateral in return. Conversely, cash-rich entities such as Money Market Funds (MMFs) often participate in the repo market by lending cash in exchange for collateral. Meanwhile, clients such as hedge funds are generally active on both sides of the market, engaging in both cash lending and borrowing as part of their trading strategies (FSB (2026)). Banks and dealers play a key role in bilateral repo markets, as they act as intermediaries between the various types of market participants (FSB (2026)).

Repos are collateralised, typically short-term transactions in which one party sells a security to another, with a commitment to repurchase it at a later date. The difference between the initial sale price and the repurchase price defines the repo rate, which reflects the cost of funding. In the event of a counterparty default, the non-defaulting party has the right to liquidate the collateral to recover potential losses. Despite their collateralised nature, repos remain in part exposed to both counterparty and collateral risks. In a default scenario, the collateral may lose value or become less liquid, thereby exposing the collateral taker to losses. To mitigate these risks, market participants apply haircuts, i.e. they value the collateral below its market price, and exchange margins, in order to cover fluctuations in collateral price and changes in credit assessments. These mitigants require the allocation of financial resources in exchange for risk protection, which must be supported by capital (Banegas and Monin (2023); Grill et al. (2025)).

Despite their crucial role in mitigating risk, recent research shows that haircuts in bilateral repo transactions are often set at very low or even zero levels (see, for example, ESMA (2024); Julliard et al. (2025); Kahn and McCormick (2025)). At the same time, empirical evidence

[1] Tri-party repo, in which collateral selection, custody, collateral management and other operations are outsourced by the parties to a third-party agent, is very common in the US repo market but marginal in Europe (ESMA (2024)).

[2] An alternative way for non-bank investors to access repo markets is sponsored repo, which involves a CCP member bank who sponsors non-dealer clients. While this segment has seen strong growth in recent years, particularly in the US, it is still a developing product in Europe (Eurex (2025)).

on margin practices - particularly outside the centrally cleared repo segment - remains very limited. This combination of opacity and lax market standards raises concerns about the potential hidden vulnerabilities and suggests that margin requirements may be insufficiently stringent, potentially encouraging excessive leverage and risk-taking, including outside the banking sector (O'Donnell and Tamburrini (2024); Hempel et al. (2023)).

Regulatory authorities and international organisations have in recent years established comprehensive reporting frameworks to enhance market transparency and monitor potential vulnerabilities (ESMA (2024); Bassi et al. (2024); Cenicola et al. (2025)). In addition, several regulatory initiatives have been considered, including proposals for minimum regulatory haircuts to limit excessive leverage (FSB (2015)) and measures to mandate or expand central clearing (FSB (2025)). Against this background, the U.S. Securities and Exchange Commission is implementing a central clearing obligation for U.S. Treasury repo transactions.[3] In the EU, the European Systemic Risk Board has recently called for a broader adoption of central clearing in cash and repo government bond markets, and for an alignment of risk management practices across bilateral and centrally cleared segments (ESRB (2024)). More recently, the Bank of England published a Discussion Paper seeking feedback on both minimum haircut proposals and central clearing mandates (Bank of England (2025a)). Related studies further explore how such regulatory measures, together with appropriate margin requirements, can mitigate vulnerabilities in repo markets, including risks associated with excessive leverage and structural trends such as the increasing role of non-bank financial intermediaries (NBFIs).

Using trade-level data from the Securities Financing Transactions Regulation (SFTR (2015)), this paper provides new insights into margining practices in the European repo market. To our knowledge, it is the first study to systematically analyse margin practices in both centrally cleared and bilateral segments, covering a diverse set of counterparties, sectors, and collateral types. Our findings highlight three main results: (i) margins levels vary across market segments and counterparties, with requirements in the bilateral segment generally lower than those in centrally cleared markets - even after controlling for collateral type, exposure size, counterparty characteristics, and other relevant factors; (ii) margins are typically set at the portfolio level based on a net exposure basis; more balanced positions are associated with lower requirements, reflecting counterparty risk assessments and enhancing collateral efficiency; (iii) margins adjust to market volatility and tail risks, though with notable variation across segments; centrally cleared trades are more affected by medium-term fluctuations, while bilateral contracts react more to short-term moves and exhibit non-linear adjustments during tail events. To complement the analysis, we examine two episodes of price fluctuation covered in our sample: the 2022 gilt turmoil and the euro area yield correction in March 2025.

An additional contribution of our work lies in the metrics employed. While prior studies on risk management practices in bilateral repo markets focus primarily on haircuts (e.g., Julliard et al. (2025); Hermes et al. (2025)), we complement this evidence by analysing margins exchanged by counterparties; in addition, we employ metrics built to consistently compare requirements across both centrally cleared and bilateral segments.

The remainder of the paper is structured as follows. Section 2 reviews the related literature. Section 3 discusses the mechanisms of margining in centrally cleared and bilateral repos, and presents the hypotheses. Section 4 describes the data, introduces the metrics used to study margin requirements, and presents descriptive statistics. The empirical analysis is divided into three separate parts: Section 5 provides structural insights on margins, Section 6 discusses the role of net positioning, and Section 7 focuses on risk factors and margin dynamics under tail events. Section 8 concludes. A detailed explanation of the main filtering and data cleaning steps is available in Section A of the Annex.

[3]Cf. SEC (2023). The implementation date of the rule has been extended in 2025, with expected compliance for eligible repo transactions currently set for June 30, 2027 - cf. SEC Press Release, 2025.

2. Literature review

Our research contributes to two main strands of the literature. First, it adds to the growing body of work examining the role and calibration of margin requirements and haircut practices in repos and other collateralised transactions, including derivatives. Second, it relates to studies on the evolution of margin requirements in response to market volatility and broader financial cycles, focusing in particular on their behaviour during stress and the potential for procyclical amplification.

Haircuts and initial margins are essential tools for managing counterparty and collateral risk. Theoretical studies have examined their role in safeguarding both bilateral counterparties and central counterparties (CCPs), addressing fundamental questions such as why haircuts exist and what drives their size (Dang et al. (2011)), how optimal margin levels can be determined (Hong and Lee (2022)), the efficiency of margin setting and portfolio-based margining (Szabó and Váradi (2022)), and their interaction with leverage and liquidity (Adrian and Shin (2010) and Brunnermeier and Pedersen (2009)).

While higher margins reduce credit and counterparty risk, they also raise trading costs. The behaviour of margins during turbulent periods is also particularly critical: margin calls, while protective, can heighten liquidity pressures and amplify systemic risk. Brunnermeier and Pedersen (2009) highlight the destabilising effects of margin calls during periods of stress, pointing to feedback loops between market and funding liquidity. Geanakoplos (2010) models margins as endogenous collateral constraints, showing how they tighten in downturns and ease in booms, thereby amplifying financial cycles. More recently, Kahn and McCormick (2025) analyse margining practices across bilateral and centrally cleared repo markets, proposing proportionate margining frameworks to mitigate systemic risk.

The empirical literature on margin practices is still developing; the majority of research is focused on the derivatives market, particularly in centrally cleared segments, where greater transparency and data availability have enabled more comprehensive analyses. Notable contributions include Capponi et al. (2022), who study the empirical determinants of initial margin requirements for CDS contracts and find that margins are largely driven by extreme tail risks. Duffie et al. (2015) document how the broader adoption of central clearing and initial margin rules affects collateral demand. Other works explore incentives for clearing bilaterally or centrally (Bellia et al. (2024)), and the role of risk management practices and competition in shaping collateral requirements in CCPs (Grothe et al. (2023)).

In contrast, repos and other securities financing markets have received comparatively less attention. In the bilateral segment, research has primarily focused on haircuts rather than comprehensive margin frameworks, largely due to limited data. Julliard et al. (2025) investigate the determinants of haircuts in the UK market, showing the importance of collateral quality, asset liquidity, maturity, and counterparty relationships. Baklanova et al. (2019) document collateral usage in US bilateral repo markets, finding that most transactions are backed by Treasuries and are structured as overnight or open maturity. Earlier work by Gorton and Metrick (2012) reports sharp increases in haircuts during the 2008 financial crisis, while Brunnermeier and Pedersen (2009) highlight the procyclical nature of margining. More recent studies confirm the prevalence of low or zero haircuts under normal market conditions, including ESMA (2024) and Hermes et al. (2025) for Europe, Julliard et al. (2025) for the UK, Banegas and Monin (2023) for the US, and Suzuki and Sasamoto (2022) for Japan. The prevalence of low (or zero) haircuts at the transaction level may also be linked to the existence of margin requirements exchanged at the portfolio-level, both within and across products (Hempel et al. (2023), FSB (2026)), highlighting an important dimension to consider when studying margining practices. However, empirical research on this aspect, particularly on the interaction between haircuts set at the trade level and margining applied at the portfolio level, remains scarce, mainly due to data limitations.

Finally, another aspect addressed in the literature concerns the potential interplay between margin requirements and repo rates, although it remains relatively underexplored (Eisenschmidt et al. (2024), Julliard et al. (2025)). Notable exceptions include Baklanova

et al. (2019), who document a negative correlation between haircuts and interest rates, and Miglietta et al. (2019), who analyse the effects of changes in initial margins in the centrally cleared segment on funding costs. Much of the existing evidence suggests that haircuts, like margins, are primarily determined by risk assessments at the contract or the portfolio level, although a range of additional factors may influence their determination. Repo rates, by contrast, largely reflect market clearing conditions in the aggregate demand and supply for funds and collateral (Julliard et al. (2025)), with substantial heterogeneity arising from the presence of special repo trades.

Relative to the existing literature, our paper is the first to investigate the determinants of margin requirements across multiple CCPs and a wide range of market participants, covering both centrally and bilaterally cleared segments. In the next section, we focus on the setting of margin requirements across market segments, which form the basis of our empirical analysis.

3. Margin practices and hypotheses development

Repo participants exchange margins to protect themselves against counterparty default. When appropriately set, margin levels should reflect the underlying risks and potential costs associated with such an event. Kahn and McCormick (2025) examine the problem of setting appropriate margins for repo contracts, emphasising that best practices include: (i) ensuring adequate protection for both parties; (ii) accounting for risks related to both the counterparty and collateral; and (iii) considering the entire portfolio of exposures. Margins that meet these criteria are referred to as "proportionate".

Margin requirements generally comprise two principal components: Initial Margin (IM) and Variation Margin (VM). IMs act as a buffer against potential future exposure, protecting counterparties from adverse price movements that may occur between margin calls. In contrast, VMs reflect daily mark-to-market changes in the value of the underlying collateral, adjusting margin requirements to align with current exposure in response to short-term price fluctuations. Together, these components play distinct, yet complementary roles in managing counterparty credit risk and promoting market resilience.

Hypothesis 1 *The level of margin requirements is heterogeneous across market segments and counterparty categories.*

The setting of margins differs substantially depending on whether transactions are centrally or bilaterally cleared. In centrally cleared markets, margins are collected by a central counterparty, operating under well-established and standardised risk management frameworks. To protect itself against counterparty default, the CCP requires both parties to post IM, enforces VM transfers to neutralise exposures, and maintains its own capital reserves, supplemented by additional safeguards (beyond margins) such as default fund contributions.[4]

In bilateral repo markets, by contrast, margins are negotiated and exchanged directly between counterparties. Although margin requirements are intended to address the same underlying risks - since repos deliver equivalent economic outcomes whether cleared centrally or bilaterally - greater heterogeneity in counterparties' risk management practices and more diverse risk profiles among participants can result in considerable variation in how margins are determined in the bilateral segment. In addition, while for OTC derivatives margin requirements have been partially aligned to the centrally cleared market following the global financial crisis (Basel Committee on Banking Supervision (2020), EMIR (2012)), no comparable regulatory framework exists for repos (ESRB (2024)). In this context, among other options, ESRB (2024) proposes to adapt to repos the mandatory initial margin rules

[4]While margin models may differ among central counterparties, EMIR (2012) and its related technical standards outline the common requirements that EU CCPs must adhere to in their margin methodologies.

currently applicable to derivatives, to align risk practices across the bilateral and centrally cleared segments.

A key source of heterogeneity between bilateral and centrally cleared markets stems from the treatment of IM. While VM is generally exchanged in a broadly similar manner across centrally and bilaterally cleared transactions (though without CCP intermediation in the latter), approaches to IM are considerably more diverse. On the one hand, in bilateral transactions, IM may take the form of a haircut applied at the trade level. A positive haircut requires the borrower to pledge collateral exceeding the cash received, protecting the lender in the event of default, whereas a negative haircut implies that the borrower posts less collateral than the cash obtained. On the other hand, when a large volume of repo transactions occurs between the same counterparties, applying haircuts to individual trades can be operationally cumbersome, and counterparties may instead prefer to manage risk through aggregate portfolio margining (ICMA (2025b)). While we focus on this latter approach and examine it in more detail in the remainder of the study, the interaction between haircuts and portfolio margining in bilateral transactions represents an additional source of heterogeneity in risk practices across segments and merits further research.

More generally, the absence of a trusted third party responsible for collecting margins, such as a CCP, generally means that IM primarily reflects only the excess risk of one party relative to the other, rather than covering the full bilateral exposure. To illustrate this point, we draw on the discussion by Kahn and McCormick (2025). Consider a bilateral repo transaction: if the borrower defaults, the lender is left with collateral that may have decreased in value; conversely, if the lender defaults, the borrower keeps the cash but loses the posted securities, which may have increased in value. Both parties face risk, and proportionate margining should in principle provide mutual protection. Focusing on haircuts, Kahn and McCormick (2025) derive an expression within a Value-at-Risk (VaR) framework in which the haircut is decomposed into two components: one capturing the lender's exposure to the borrower, and the other capturing the borrower's exposure to the lender. Because haircuts are inherently one-sided, i.e. they allow only one party to provide protection to the other (either through excess collateral or excess cash), both the sign and magnitude of the haircut depend on the relative risk profiles of counterparties and on the distribution of collateral returns. If the borrower's risk of losing valuable securities exceeds the lender's risk of losing cash, the outcome is a net initial margin requirement flowing from the lender to the borrower (equivalent to a negative haircut). The same reasoning applies regardless of how IM is structured in bilateral transactions, whether through haircuts or aggregate portfolio margining. In non-centrally cleared repo markets, the absence of a trusted third party turns margin protection into a zero-sum game: margin flows generally cover only the counterparty with the greater exposure, taking protection away from the other party. All else equal, this mechanism may lead to a lower overall level of initial margin requirements in the bilateral segment.

Hypothesis 2 *The direction of margin flows varies across market segments, collateral types, and counterparty categories.*

We examine whether margin flows exhibit systematic directional patterns, expecting riskier counterparties to act as net margin payers - irrespective of their net repo position (i.e., as cash borrowers or lenders). For example, hedge funds might lend cash to dealers in order to acquire specific securities to short. In such cases, dealers, facing a potentially risky lender, may require the hedge fund to post initial margin to protect themselves. Alternatively, in interdealer transactions - where both counterparties value comparable default risks - the IM component may be minimal, with net margin transfers primarily driven by variation margin payments based on mark-to-market changes in collateral prices.

Hypothesis 3 *Net exposures at the counterparty pair level are determinants of margin requirements.*

From a risk management standpoint, applying portfolio margining based on net exposures might be more effective than margining gross positions or relying exclusively on transaction-level risk mitigants such as haircuts. ICMA (2025b) argues that a more holistic approach that applies margining at the counterparty exposure level would be more effective from a risk management perspective, particularly when set-off netting agreements covering multiple products and contractual frameworks exist between parties.[5] In the non-centrally cleared, bilateral segment of the US Treasury repo market, participants employ portfolio margining to manage counterparty exposures, with margin requirements calibrated to aggregate net exposures across multiple trades (TMPG (2025)). This perspective forms the foundation of this paper, as it provides empirical evidence on portfolio-level margining practices, attempting to fill a relevant gap in the literature. In particular, we expect larger net exposures - corresponding to less balanced portfolios - to be associated with higher margin requirements.

Hypothesis 4 *Margins are proportionate to the volatility of the posted collateral.*

Finally, proportionate margins should reflect the risk profile of the collateral, with volatility expected to be a key driver of requirements in both segments. Accordingly, we investigate how margins are revised over time to account for changes in collateral risk.

4. Data and Methodology

4.1. The SFTR database

We use data from the Securities Financing Transactions Regulation (SFTR) dataset, which contains granular, transaction-level information on Securities Financing Transactions (SFTs) conducted in the EU. The dataset, managed by the European Securities and Markets Authority (ESMA), includes all SFT trades where at least one of the counterparties is domiciled in the European Union. Market participants are required to send daily reports to Trade Repositories about their SFT transactions, including repos, securities lending, and margin lending. The reporting contains information from the second half of 2020 onwards. The data collection provides granular information on single transactions between counterparties, including the identities of the two sides, the volumes exchanged, the instruments employed as collateral, the economic terms of the transaction (e.g. the haircut and the rate applied), and a range of other characteristics. For a detailed description of the dataset and its main features, see ESMA (2024) and Bassi et al. (2024).

We combine multiple types of reports available in this dataset, notably (i) information on margins exchanged and (ii) information on repo outstanding amounts. Regarding margins, we employ data for centrally-cleared repos from a specific section of the SFTR reporting.[6] Furthermore, we complement margin information with data for the non-centrally cleared segment, collected in the SFTR reporting as variation margins exchanged on a net exposure basis.[7] These reports contain granular details on the type of collateral posted as margin (e.g. cash or securities), along with the identification of the security in the latter case. For comparability with the centrally cleared segment, in our study, we aggregate bilateral margins at counterparty pair level, regardless of their composition. Finally, we complement regulatory information with sovereign bond yield data from Refinitiv.

[5]ICMA (2025b) also highlights that this portfolio approach to margining could extend to other transactions and exposures, including prime brokerage, margin lending and OTC derivatives. In the European context, ECB (2025) reports that most banks allow margin offsets between repo and reverse repo activity collateralised by government bonds of the euro area, while offsets across products are less common and are usually reserved for a minority of clients. Similar findings were reported by dealers in US Treasury markets (FRB (2025)).

[6]For more information on the data structure, see Table 3 in the Regulatory Technical Standards.

[7]For further details, see ESMA's Guidelines on reporting under SFTR.

4.2. Metrics

We construct repo exposures from trade-activity reports, by aggregating outstanding repo and reverse repo transactions at the bilateral counterparty level for each date.[8] Our unit of analysis is thus the counterparty pair level, in order to be able to merge repo exposures with margin data. We combine exposure and margin information, and propose a range of different metrics to examine the margining practices in our data. Furthermore, we employ other available information (e.g. collateral) to characterise the resulting portfolios.

Exposure metrics. We aggregate outstanding repo and reverse repo amounts to compute, for each day t, gross repo exposures at the counterparty pair level:

$$GrossExposure_{ij} = Repo_{ij} + ReverseRepo_{ij} \tag{1}$$

Next, for each day t and for each counterparty pair $\{i, j\}$, we compute the net repo exposure in the following way:

$$NetExposure_{ij} = Repo_{ij} - ReverseRepo_{ij} \tag{2}$$

Positive (negative) values of variable $NetExposure_{ij}$ imply that i is a net borrower (lender) with respect to j. Finally, we combine Eq.(1) and Eq.(2), and propose a metric that captures the relative imbalance of a position relative to its size for each day t:

$$PortfolioImbalance_{ij} = \frac{|NetExposure_{ij}|}{GrossExposure_{ij}} \times 100 \tag{3}$$

Margin metrics. Margin is reported at the portfolio level in SFTR, representing the stock of margin collected or exchanged on a given date. In the centrally cleared segment, CCPs collect daily *Initial Margin (IM)* and *Variation Margin (VM)* from both counterparties. We combine these two measures in order to obtain a single value for centrally-cleared exposures. Thus, considering cleared trades, the net margin stock posted from i to j for each date is given by:

$$NetMargin_{ij}^{Cleared} = IMPosted_{ij} + VMPosted_{ij} - VMReceived_{ij} \tag{4}$$

Our approach to compute the net margin stock is analogous to Macchiati et al. (2025), which employs similar data, despite focusing on centrally cleared derivative markets.

In the bilateral segment, margins are exchanged by the two counterparties and may be posted in the form of cash or securities. From a reporting perspective, margins are reported as a single signed value that indicates the direction of collateral flows. The value represents the end-of-day stock for each collateral component k (henceforth $NetExpCollateral^k$), with the sign indicating whether margins were received or posted overall.[9]

To ensure consistency with the centrally cleared segment, we aggregate reported margins on a net basis at the counterparty-pair level. The selected approach has the drawback of potentially netting offsetting net exposure collateral positions. However, this is unlikely to materially affect our results, as the stocks of reported net exposure collateral almost always exhibit the same directionality (i.e. on a given date and for a given counterparty pair, they are all either posted or received).[10]

For each day, the net (bilateral) margin stock posted from i to j is given by:

[8] See section *SFTR data reporting* in ESMA (2024) for a detailed description of state and activity data.

[9] For further details, see ESMA's Guidelines on reporting under SFTR.

[10] The few cases of offsetting flows identified in the data likely correspond to collateral swaps. We therefore consider the risk of bias from netting opposite-direction flows to be limited.

$$NetMargin_{ij}^{Bil} = \sum_{k} NetExpCollateral_{ij}^{k} \tag{5}$$

where each k represents one of the components of net exposure collateral.

We construct both metrics in order to have positive (negative) values corresponding to margin posted (received) by the reporting counterparty i. After collecting the net margin for both market segments, we expressed it as a percentage of the notional exposure, following the approach of Foley et al. (2022), i.e. the level of margin per unit of (gross) repo exposure. For example, if a margin of EUR 5 mn has been posted against a gross repo exposure of EUR 100 mn, the resulting percentage margin is 5%. This metric enables more consistent comparisons across market segments and exposure levels. Specifically, in the rest of the paper and in our econometric setting, we will refer to the following two measures:

$$NetMargin_{ij}^{\%} = \frac{NetMargin_{ij}}{GrossExposure_{ij}} \times 100 \tag{6}$$

$$AbsMargin_{ij}^{\%} = \frac{|NetMargin_{ij}|}{GrossExposure_{ij}} \times 100 \tag{7}$$

Risk metrics. Given the dominant role of sovereign bond collateral in our sample (cf. Figure A.1 and Figure A.2) and in the broader context of the repo market, we select and compute risk metrics derived from the bond yields of representative collateral in our sample. Specifically, for each date in our sample and for each major collateral issuer, we compute two risk metrics: (i) the daily change in the 10-year sovereign bond yield (i.e. *1D Delta Yield*) and (ii) a volatility measure, defined as the standard deviation of the *1D Delta Yield* over a monthly period (a 22 trading days rolling window). While daily yield changes are expected to capture more immediate market movements and are likely reflected in the variation margin component of margin requirements, the rolling standard deviation measure is more closely associated with shifts in volatility regimes and broader market uncertainty over longer horizons, likely exerting a stronger influence on the initial margin component. Since both factors are expected to influence the levels of margins exchanged by market participants, together they allow us to capture the dynamic interplay between short-term market fluctuations and longer-term volatility patterns within the repo collateral environment.

A limitation of our framework lies in the treatment of haircuts in bilateral repo transactions, which are not considered in this analysis. Their exclusion reflects the challenge of reconciling two distinct data perspectives: aggregate portfolio-level snapshots that capture net exposures and margin requirements at specific dates, and granular transaction-level records that document individual contract terms established at deal origination. Nevertheless, the impact of this choice is deemed to be limited, given the dominant role of zero or very low trade-level haircuts in bilateral repo markets (ESMA (2024), Grill et al. (2025) and Hempel et al. (2023)).

4.3. Sample description

We focus on the period between 1 June 2022 and 1 June 2025, and include repos denominated in the most common currencies reported in SFTR data (EUR, USD and GBP). To facilitate interpretation of the results and avoid double-counting of centrally cleared trades, we take the perspective of reporting banks based in the EEA.

Thus, the reporting counterparties in our sample are all banks, engaging in repo and reverse repo trades with a variety of counterparties, such as CCPs - in the centrally cleared segment - and other banks or non-bank entities in the bilateral segment. Specifically, our sample includes investment funds, Insurance Corporations and Pension Funds (ICPFs), Money Market Funds (MMFs) and others. We distinguish between EEA investment funds, regulated

under either the UCITS or the AIFMD directives[11], and foreign investment funds (i.e., investment funds not domiciled in the European Economic Area). While a detailed classification of foreign investment funds within the sample is not available, this category also encompasses market participants based in offshore financial centers who pursue hedge fund strategies and actively engage in repo markets (ESRB (2025)). A comprehensive description of the data filtering and cleaning procedures is provided in Section A of the Annex.

Descriptive statistics for our sample are reported in Table 1. Some observable patterns are worth mentioning. First, net margins in the bilateral segment span both positive and negative values. As detailed in Section 4.2, positive values indicate margin posted by the reporting bank i to counterparty j, while negative values represent margin received by bank i from counterparty j. In contrast, as expected, reporting banks consistently provide margin to CCPs in the centrally cleared segment, although they may receive variation margin when collateral valuations are favourable. Second, the variable $NetMargin^{\%}$ is characterised by a large presence of zero values in the bilateral segment. In this respect, a key methodological consideration is our treatment of missing data: observations lacking margin information are coded as zero values. We elaborate further on possible drivers of zero margins in Section 5.1. Third, the average level of margins exchanged is significantly higher in the centrally-cleared segment. Fourth, centrally-cleared portfolios show both higher net exposure values and lower values of portfolio imbalance, suggesting the presence of larger and more complex repo portfolios between banks and CCPs, in comparison to the bilateral segment.

Table 1: Summary statistics

Variables	N	Mean	P1	P5	P10	P25	P50	P75	P90	P95	P99
Net Margin (EUR bn)	7,483,007	0.002	−0.018	−0.001	0	0	0	0	0	0.001	0.048
Net Margin (% of exposure)	7,483,007	−0.101	−8.997	−0.630	0	0	0	0	0	0.240	5.955
Centrally-cleared	109,490	4.705	0.070	0.502	0.982	1.859	3.414	5.854	9.648	13.918	24.329
Bilateral	7,373,517	−0.172	−9.153	−0.658	0	0	0	0	0	0	3.380
Abs. Margin (EUR bn)	7,483,007	0.004	0	0	0	0	0	0	0.001	0.005	0.079
Abs. Margin (% of exposure)	7,483,007	0.560	0	0	0	0	0	0	0.441	2.281	14.837
Centrally-cleared	109,490	4.705	0.070	0.502	0.982	1.859	3.414	5.854	9.648	13.918	24.329
Bilateral	7,373,517	0.498	0	0	0	0	0	0	0.252	1.643	14.101
Net repo exposure (EUR bn)	7,483,007	−0.001	−1.434	−0.354	−0.117	−0.001	0.000	0.001	0.090	0.315	1.456
Centrally-cleared	109,490	0.810	-8.561	-3.947	-1.835	-0.140	0.287	1.600	4.418	6.848	11.655
Bilateral	7,373,517	-0.013	-1.312	-0.331	-0.111	0.000	0.000	0.001	0.070	0.261	1.118
Portfolio imbalance (% of exposure)	7,483,007	94.055	0.397	33.303	100	100	100	100	100	100	100
Centrally-cleared	109,490	67.270	0.101	3.567	8.522	30.601	87.497	100	100	100	100
Bilateral	7,373,517	94.453	0.421	36.866	100	100	100	100	100	100	100

Note: Number of observations, mean and distribution of key variables. Positive (negative) margin values represent margin posted (received) by the reporting bank. Net repo exposure defined in Eq. (2); Portfolio Imbalance defined in Eq. (3). Data source: SFTR.

In terms of collateral composition, the repo portfolios in our sample are mainly backed by EU government bonds, with a particularly relevant role of DE, FR and IT sovereigns. This is particularly true for the centrally cleared segment (Figure A.1), while larger heterogeneity, in terms of asset classes, is found in the bilateral one (Figure A.2). Additionally, since our analysis focuses on the counterparty pair dimension, we classify portfolios based on the most relevant collateral exchanged between the pair.[12]

5. Margins and market structure: empirical results

5.1. Margin size

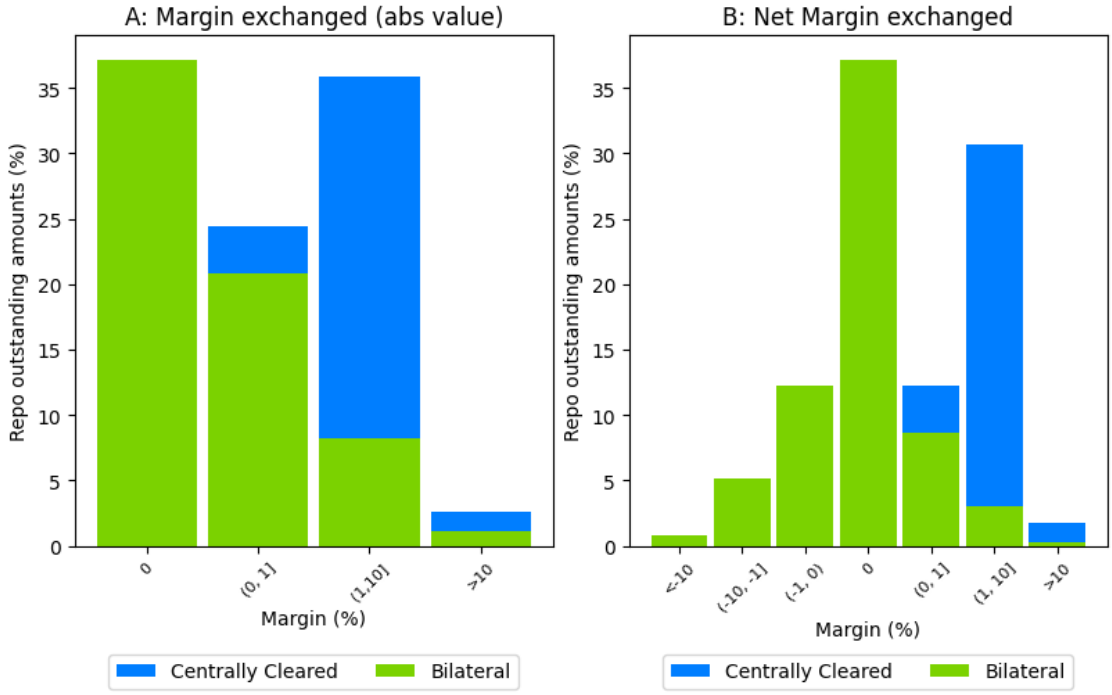
Our initial finding concerns the comparative analysis of margin levels across distinct market segments. As preliminarily indicated in Section 4, the predominant pattern observed

[11]The Undertakings for the Collective Investment in Transferable Securities (UCITS) Directive and the Alternative Investment Fund Managers Directive (AIFMD) establish the regulatory framework governing EEA investment funds and asset managers.

[12]See Annex A for further details.

in our sample reveals that most bilateral portfolios are characterised by minimal or zero margins (Table 1). To provide a more comprehensive perspective beyond basic distributional statistics, we examine the allocation of outstanding repo amounts at different margin levels (Figure 1).

Figure 1: Distribution of repo outstanding amounts by margin level



Note: Distribution of repo outstanding amounts (gross exposure) by margin level and market segment. Panel A shows margin in absolute value, while Panel B shows net margins. Positive (negative) values correspond to margin posted (received) by reporting banks. Data weighted by gross exposure. Daily data shown with weekly sampling frequency.
Source: SFTR, authors' calculations.

In the bilateral segment, the distribution of exposures differs significantly from that of the number of records. Although zero-margin portfolios account for more than 80% of bilateral repo records, they correspond to 55% of total gross exposure in this segment. Portfolios with margin requirements within the (0,1%] range (relative to their exposure) account for an additional 31% of total amounts outstanding. It should also be noted that only 12% of the outstanding amounts in bilateral repos fall within the 1-10% margin range, while this same margin bucket accounts for 83% of the total exposures in cleared repos. These patterns suggest that margin levels applied in the centrally cleared segment are generally higher. Our preliminary examination of margin levels is in line with anecdotal evidence from the United Kingdom mentioned in FSB (2026), which reports initial margins as low as 1% (or below) for highly netted portfolios and up to 10% for directional ones.

We explore these findings in more detail through regression analysis. We test Hypothesis 1 by running panel FE regressions of the form:

$$Margin^{\%}_{ijt} = \alpha_i + \gamma_c + \delta_t + \beta_1 Bilateral_{ij} + \beta_2 Bilateral : BankNonBank_{ij} + \epsilon_{ijt} \qquad (8)$$

where:

- $Margin^{\%}_{ijt}$ is the percentage margin, in absolute value or in net terms (as defined in Section 4.2), depending on the specification;

- $Bilateral_{ij}$ is a dummy variable indicating if the repo position is not centrally-cleared;
- $Bilateral : BankNonBank_{ij}$ is a dummy variable indicating if the repo position is between the reporting bank and a non-bank entity;
- Fixed Effects: α_i are reporting bank FE, δ_t daily FE, γ_c collateral type FE. The latter refer to the collateral classification described in Annex A, which combines asset type and issuer jurisdiction.

First, we focus on the absolute level of margins, employing $AbsMargin_{ij}^{\%}$ as the dependent variable in Eq. (8). The results are shown in Table 2. In this setting, the baseline reference category is always the centrally-cleared segment. For clarity, in column (1) the dummy $Bilateral_{ij}$ represents all repo positions which are not centrally-cleared, while in column (2) the same dummy, when combined with $Bilateral : BankNonBank_{ij}$, effectively captures the interbank category. We also estimate the regression outlined in Eq. (8) in two separate cases, i.e. where the reporting bank is a net lender (columns (3) to (4)) and where it is a net borrower (columns (5) to (6)). The coefficients indicate a substantial and significant difference between segments: absolute bilateral margins are approximately 5.9 percentage points lower than cleared margins. Moreover, column (2) of Table 2 suggests that the difference is more profound in the Bank-to-NonBank subsample. Interestingly, columns (3) and (4) show no significant differences, suggesting that, from a lending bank's perspective, margins in bilateral repos are similar regardless of counterparty type. In contrast, column (6) reveals significantly lower margins in Bank-to-NonBank portfolios when the bank is a net borrower. Section 5.2 explores more in detail this difference, which requires evidence on the sign of the margin exchanged for a proper interpretation.

Table 2: Absolute Margin by market segment

Dep. variable: Absolute Margin (%)	(1) Full sample	(2) Full sample	(3) Bank lender	(4) Bank lender	(5) Bank borrower	(6) Bank borrower
Bilateral	-5.867***	-5.739***	-6.646***	-6.644***	-5.586***	-5.252***
	(0.031)	(0.031)	(0.065)	(0.064)	(0.037)	(0.038)
Bilateral: Bank-to-NonBank		-0.379***		-0.006		-1.035***
		(0.009)		(0.011)		(0.018)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Date FE	Yes	Yes	Yes	Yes	Yes	Yes
Collateral FE	Yes	Yes	Yes	Yes	Yes	Yes
Margin sign FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7510852	7510852	1931240	1931240	5579601	5579601
Adjusted R^2	0.27	0.27	0.24	0.24	0.32	0.32

Note: The dependent variable is the absolute margin exchanged, in percentage of gross exposure. Collateral FE represent the largest collateral asset pledged, in terms of gross exposure. Robust standard errors (clustered daily) in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% level, respectively.

Regarding the relevant presence of zero margins in the bilateral segment, we note that this could be explained by a number of reasons. First, economic explanations could include balanced offsetting positions, resulting in marginal net exposures, or large numbers of transactions potentially collateralised through trade-level haircuts - even though this option seems unlikely, considering the recent evidence highlighting low haircut levels (ESMA (2024), Julliard et al. (2025), and Banegas and Monin (2023)). Furthermore, counterparties may contractually agree on a minimum threshold (or *minimum transfer amount*), negotiated bilaterally and specified through Master Agreements, which implies that portfolios that do not cross such net exposure threshold do not trigger margin exchanges.[13] Such information is not available in our dataset; however, suggestive evidence of this is the fact that zero-margin portfolios are concentrated in the lowest net exposure bracket, as can also be seen in Figure A.3. Finally, potential misalignment in the identity of the reporting entities might cause

[13]See ICMA (2025a), p.76.

difficulties in reconciling exposures and margin data.[14] However, considering the available margin records reported in the sample period, we do not find significant evidence of a large unmatched section of the data.

5.2. Margin sign

As discussed in detail in Section 3, in centrally cleared transactions, CCPs collect margins from both counterparties, while, in bilateral transactions managed at the portfolio level, counterparties negotiate an exchange of margins between themselves, depending on a series of factors. In this section, in order to test Hypothesis 2, we analyse the direction of the margin exchange between counterparties. The focus is primarily on the bilateral patterns, as the direction of margin exchange in the centrally cleared segment is expected. We maintain the regression framework introduced in Eq. (8), but use as dependent variable $NetMargin_{ij}^{\%}$ (instead of the absolute one). The results are presented in Table 3.

Table 3: Net Margin by market segment

Dep. variable: Net Margin (%)	(1) Full sample	(2) Full sample	(3) Bank lender	(4) Bank lender	(5) Bank borrower	(6) Bank borrower
Bilateral	-7.099***	-7.014***	-8.357***	-8.327***	-6.354***	-6.192***
	(0.033)	(0.033)	(0.067)	(0.068)	(0.036)	(0.036)
Bilateral: Bank-to-NonBank		-0.268***		-0.094***		-0.537***
		(0.009)		(0.012)		(0.020)
Constant	6.866***	6.986***	7.352***	7.374***	6.392***	6.681***
	(0.032)	(0.032)	(0.066)	(0.065)	(0.035)	(0.037)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Date FE	Yes	Yes	Yes	Yes	Yes	Yes
Collateral FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7510852	7510852	1931240	1931240	5579601	5579601
Adjusted R^2	0.14	0.14	0.16	0.16	0.24	0.24

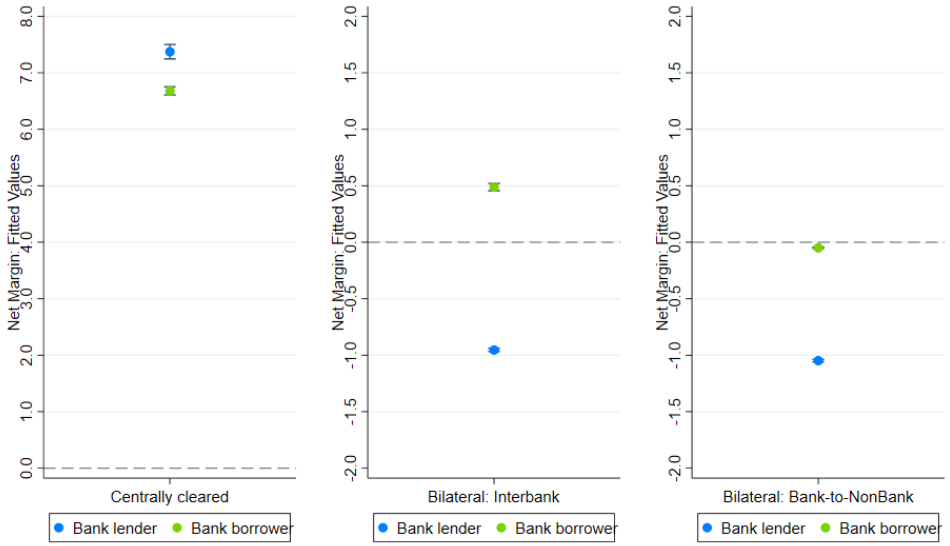
Note: The dependent variable is the net margin exchanged, in percentage of gross exposure. Collateral FE represent the largest collateral asset pledged, in terms of gross exposure. Robust standard errors (clustered daily) in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% level, respectively.

The coefficients of the *Bilateral* dummies show lower values compared to the previous results due to the way the margin is reported: a negative value implies that the margin is received by the reporting bank. The constant term is reported in Table 3 to facilitate the interpretation of the results; if the absolute value of the *Bilateral* coefficient is larger than the constant term, the reporting bank is in fact receiving the margin (on average). Indeed, the coefficients in columns (1) and (2) indicate that, in the bilateral segment, reporting banks on average receive margins, rather than posting them. This finding remains true when the reporting bank is a net repo lender, regardless of whether it deals with another bank or with a non-bank entity (columns (3) and (4)).

On the other hand, examining the last two columns - i.e. the instance when the reporting bank is a net repo borrower - it is possible to notice that the two dummies employed are relevant in determining the sign of the average net margin. To clarify this impact on the direction of the average margins exchanged, we visualise in Figure 2 the average fitted values obtained from columns (4) and (6) in Table 3.

[14]For example, an asset manager reporting margin relative to multiple fund positions with the same counterparty.

Figure 2: Fitted values of Net Margin, by bank position and market segment



Note: Average predicted value of net margin exchanged, in percentage of gross exposure, based on the panel FE regression shown in Table 3. Positive (negative) fitted values represent margin posted (received) by the reporting bank.
Source: SFTR, authors' calculations.

Three main results are summarised in Figure 2. First, margins exchanged in the centrally cleared segment are consistently larger, on average, than those in the bilateral segment, even after controlling for bank, time, and collateral fixed effects.[15] The difference in magnitude aligns with the findings presented in Section 5.1. We attribute this to more robust risk management practices by CCPs and to the significant role that IM plays in the centrally cleared segment. Second, in interbank repos, the borrowing counterparty typically pays the margin, with average margins ranging between 0.5% and 1% of the gross exposure, in absolute terms. Third, the Bank-to-NonBank segment exhibits asymmetric margin behaviour: banks usually receive margins from counterparties when acting as net cash lenders, but generally do not pay margins when serving as net cash borrowers - a pattern that differs markedly from the interbank case. More specifically, in the case of a non-bank cash lender (i.e. bank as net borrower), the average margin is close to zero and slightly negative, suggesting that margins may occasionally flow to the reporting bank even when it is a net cash borrower.

We further investigate the heterogeneity in the Bank-to-NonBank segment by distinguishing between the sectors of the non-bank counterparties and running separate regressions for each sector. The fitted values by non-bank sector are shown in Table 4, while the corresponding regression results are available in Table A.3. Two notable results should be mentioned: (i) when banks borrow from non-banks, they receive margins on average from all counterparties except Money Market Funds (MMF); (ii) foreign investment funds show the lowest margins paid or received relative to other non-bank sectors.

[15]For completeness, fitted values are shown in Table A.2 in the Annex.

Table 4: Fitted values of Net Margin, by bank position and counterparty sector

Bank side	Sector	Fitted values (mean)	Std. Dev.	Lower CI	Upper CI
Borrowing	EEA Inv. Fund	-0.25	0.02	-0.28	-0.21
Borrowing	Foreign Inv. Fund	-0.04	0.01	-0.06	-0.01
Borrowing	ICPF	-1.24	0.05	-1.33	-1.15
Borrowing	MMF	0.01	0.00	0.01	0.01
Borrowing	OFI	-0.25	0.02	-0.30	-0.21
Borrowing	Other	-0.03	0.00	-0.03	-0.02
Lending	EEA Inv. Fund	-1.30	0.04	-1.38	-1.22
Lending	Foreign Inv. Fund	-0.14	0.01	-0.15	-0.13
Lending	ICPF	-0.87	0.03	-0.92	-0.81
Lending	OFI	-0.55	0.03	-0.62	-0.49
Lending	Other	-0.36	0.05	-0.45	-0.27

Note: The table shows the average predicted value of the net margin exchanged, in percentage of gross exposure, based on the panel FE regression shown in Table A.3. Positive (negative) fitted values represent margin posted (received) by the reporting bank. The subsample considered includes only the Bank-to-NonBank segment, split by the sector of the non-bank counterparty (in column titles). $ICPF$ = Insurance Corporations & Pension Funds, MMF = Money Market Fund, OFI = Other Financial Institutions. Collateral FE represent the largest collateral asset pledged, in terms of gross exposure. Robust standard errors (clustered daily) in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% level, respectively.

The heterogeneity identified in the bilateral segment can be linked to multiple factors. Notably, we expect different operational efficiencies and credit monitoring capabilities between counterparty types (e.g. banks vs non-banks). Moreover, different overall risk profiles can impact the risk management of the repo portfolios, potentially leading to higher requirements imposed by dealers to riskier non-bank counterparties. This interpretation is consistent with evidence from repo haircut practices. In bilateral repos where dealers borrow from relatively safe counterparties, such as MMFs, haircuts are generally positive, providing protection to lenders by requiring collateral in excess of the cash lent (Kahn and McCormick (2025)). By contrast, in trades with other non-bank counterparties, haircuts are often smaller or even negative, shifting protection from lenders to borrowers. In these settings, the perceived risk of the borrower losing posted collateral may outweigh the lender's risk of losing cash, reflecting differences in relative credit risk between dealers and non-bank counterparties (Hempel et al. (2023)). Finally, market power and the structure of bilateral relationship networks may also influence margin requirements. Non-banks connected to multiple dealers may benefit from greater bargaining power and, all else equal, face lower margin requirements due to greater dealer competition.

Although our analytical approach incorporates a comprehensive set of fixed effects, it does not extend to counterparty-level fixed effects or specific risk factors, such as default probabilities or entity-level CDS spreads. Instead, we examine counterparty heterogeneity by analyzing the different types of entities represented in our sample. However, it is important to acknowledge that margin determination may also be influenced by unobserved counterparty-specific risk factors that are not captured in our analysis.

6. The role of net positioning

Repo counterparties often engage in multiple transactions that involve both borrowing and lending of cash and collateral. From a risk management perspective, portfolio margining based on net exposures can be more effective than margining on gross positions or relying solely on transactional-level risk mitigants, such as haircuts. This is because it more accurately reflects the actual risk that a counterparty faces, for example when compared to gross exposures, and enables more efficient use of collateral while avoiding the operational complexity of applying haircuts to each individual trade. According to ICMA (2025b), it is only by examining a bank's net exposure to a counterparty, along with the associated liquidation risk, that one can determine whether the bank has sufficient margin to mitigate this risk.

To illustrate this, consider a counterparty with significant long positions in volatile securities that are not offset by corresponding short positions. Such an imbalanced portfolio

is subject to greater price fluctuation risk and, consequently, requires a higher margin to safeguard against potential losses. Conversely, when long and short positions are balanced, particularly if they are backed by the same or highly correlated collateral, the net risk is reduced, allowing for lower margin requirements. As a concrete example, take a repo participant with EUR 10 mn in borrowing positions and EUR 8 mn in lending positions, both backed by similar or highly correlated securities. The relevant exposure for margining purposes is the EUR 2 mn net position, rather than the full EUR 18 mn gross exposure. This is because a price change in the underlying collateral is likely to impact both sides of the position symmetrically, thus partially offsetting the associated risk. Consequently, the collateral required to secure the transaction is reduced, fostering greater liquidity and efficiency in the repo market.

In this section, we empirically examine whether net exposures - and, in particular, the degree of imbalance between long and short repo positions at the counterparty-pair level - are reflected in margin requirements. Specifically, we focus on testing Hypothesis 3, which posits that less balanced, and therefore riskier, portfolios are generally associated with higher margins.

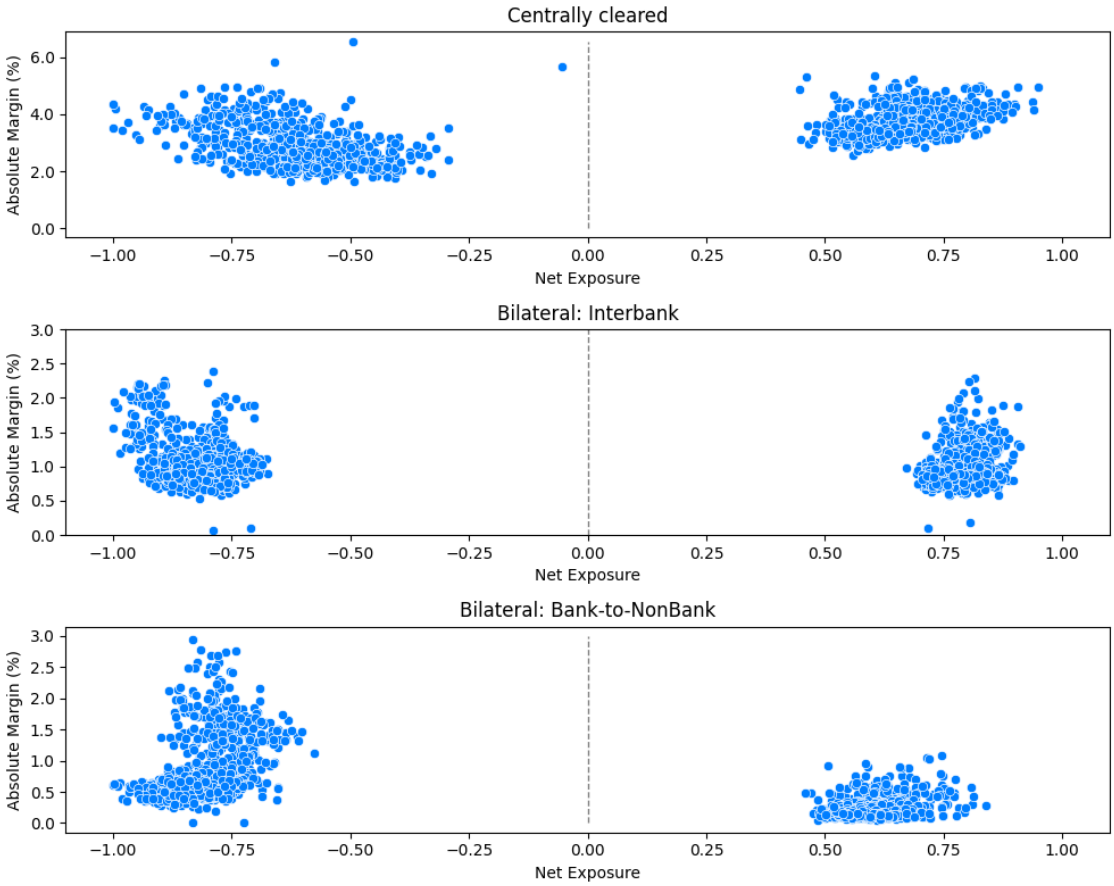
6.1. Margin patterns across segments

In Figure 3 we show a series of scatter plots displaying the distribution of margin levels across three market segments: centrally cleared transactions, bilateral interbank transactions and bilateral bank-to-nonbank transactions. The vertical axis shows the average daily margin posted or received by the banks in our sample, either with CCPs in the centrally cleared segment or with bilateral counterparties, as a percentage of gross exposure (as defined in Eq. (7)). The horizontal axis shows the net exposure of the repo portfolio at the level of the counterparty pair, as defined in Section 4.2.

Three main patterns emerge from the data. First, margin levels exhibit different relationships with net exposures across market segments. In the centrally cleared space, a clearer relationship appears to exist between margin levels and counterparty exposure than in bilateral segments, where this relationship is less evident. Second, the degree of imbalance between borrowing and lending positions at the portfolio level varies across market segments. Portfolios in bilateral markets tend to be more "directional" (i.e., more one-sided positions), while centrally cleared portfolios exhibit a broader spectrum of imbalances. This difference likely stems from structural factors: in centrally cleared markets, netting is performed through a central counterparty (CCP) across multiple counterparties, facilitating greater offsetting and resulting in more balanced portfolios overall. Conversely, bilateral exposures are confined to individual counterparty relationships, limiting netting opportunities and leading to more one-sided, directional portfolios. Third, when portfolios that are predominantly net borrowing (right-hand side of the plots) are compared with those that are predominantly net lending (left-hand side), some asymmetries emerge, particularly in the bilateral bank-to-nonbank segment.

These patterns may reflect differences in the types of participants active on each side of the market, including variations in sectoral composition, risk profiles, collateral availability, and the nature of bilateral trading relationships. Asymmetries may also partly stem from collateral price dynamics during the sample period, which could have affected the margining of borrowing and lending positions differently.

Figure 3: Absolute Margin by net position of reporting bank and segment

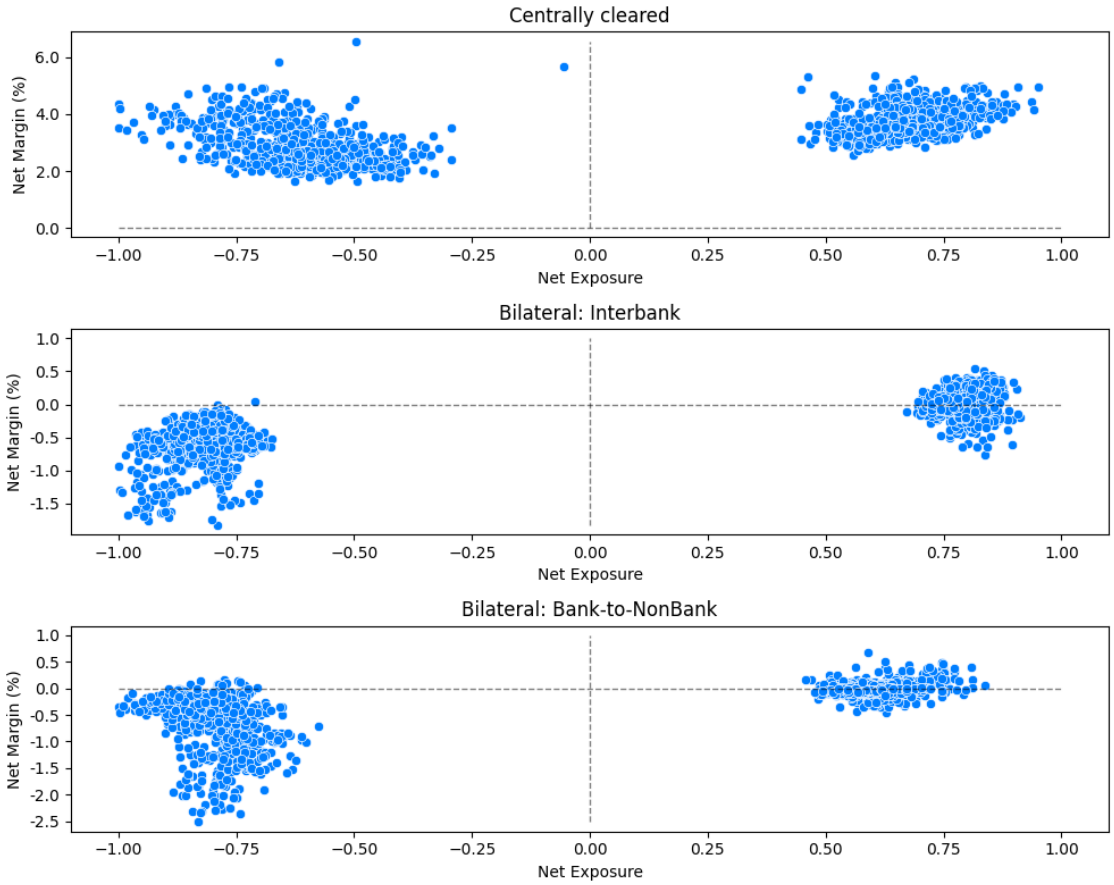


Note: Distribution of average margin, in absolute value, by net exposure level and market segment. Each dot represents the average mean margin on a given date for net borrowing and net lending portfolios. Net exposure scaled between -1 and 1, with values above (below) 0 representing portfolios where reporting banks are net borrowers (lenders).
Source: SFTR, authors' calculations.

To complement the analysis, Figure 4 presents analogous scatter plots that, similar to the approach taken in Section 5.2, account for the direction of margin exchanged between counterparties. In these plots, positive values on the y-axis represent margins posted by the reporting bank, while negative values indicate margins received. The plots compare this distribution with the level of net exposures at the counterparty pair level.

The figure provides further evidence of significant differences in margin setting practices across market segments. As highlighted in Section 5.2, centrally cleared portfolios consistently exhibit positive margin values, reflecting the obligation for participants to post margin to CCPs, regardless of their net borrowing or lending status. In contrast, the bilateral segment exhibits a variety of margining practices: banks often appear as significant recipients of margin on lending portfolios, while margin flows on borrowing positions range from positive to negative values centred around zero.

Figure 4: Net Margin by net position of reporting bank and segment



Note: Distribution of average net margin, by net exposure level and market segment. Positive (negative) margin values represent margin posted (received) by the reporting bank. Each dot represents the average mean margin on a given date for net borrowing and net lending portfolios. Net exposure scaled between -1 and 1, with values above (below) 0 representing portfolios where reporting banks are net borrowers (lenders).
Source: SFTR, authors' calculations.

Additionally, a clearer relationship between margin flows and net exposures emerges in centrally cleared markets, whereas in the bilateral segment, the relationship is less distinct and more fragmented, suggesting the potential influence of additional factors. To gain a deeper understanding of how net exposures influence margin requirements, the following section presents an empirical investigation of margin dynamics across market segments.

6.2. The role of portfolio imbalance

This section presents an econometric analysis to empirically examine the extent to which net exposures influence margin requirements across different market segments, based on the descriptive patterns highlighted in the previous paragraphs. To test Hypothesis 3, we estimate the following specification:

$$\begin{aligned} Margin^{\%}_{ijt} = \alpha_i + \gamma_c + \delta_t + \beta_1 Bilateral_{ij} \\ + \beta_2 Bilateral : BankNonBank_{ij} + \beta_3 BalancedPtf_{ijt-1} + \epsilon_{ijt} \end{aligned} \tag{9}$$

where $BalancedPtf_t$ is a dummy variable equal to one if the corresponding portfolio exhibits a low level of imbalance relative to its size; specifically, if the $PtfImbalance$ measure (defined in Eq. (3)) is less than 15% as of date t. All other variables are defined in Eq. (8). The specification includes fixed effects for the bank, date, and collateral type.

One challenge in estimating Eq. (9) is a potential endogeneity risk between margin requirements and portfolio imbalance. A particular concern is reverse causality, given that we cannot rule out the possibility that margin revisions might influence the level of exposure between counterparties, or that these requirements in some segments are jointly determined by the parties when concluding transactions. To address this, we include $BalancedPtf$ with a one-day lag in the specification, in order to mitigate the risk of simultaneity bias when estimating the relationship between the imbalance of repo positions and margin requirements.

Table 5: Absolute Margin in Balanced Portfolios

Dep. variable: Absolute Margin (%)	(1) Full sample	(2) Centrally cleared	(3) Bilateral	(4) Bilateral: Interbank	(5) Bilateral: Bank-to-NonBank
Bilateral	-4.779***				
	(0.032)				
Bilateral: Bank-to-NonBank	-0.688***		-0.676***		
	(0.011)		(0.011)		
Balanced Portfolio	-0.793***	-1.484***	-0.652***	-0.645***	-0.575***
	(0.020)	(0.091)	(0.022)	(0.025)	(0.025)
Bank FE	Yes	Yes	Yes	Yes	Yes
Date FE	Yes	Yes	Yes	Yes	Yes
Collateral FE	Yes	Yes	Yes	Yes	Yes
Observations	7510852	113880	7396970	1695022	5701947
Adjusted R^2	0.23	0.30	0.24	0.26	0.20

Note: The dependent variable is the absolute margin exchanged, in percentage of gross exposure. Collateral FE represent the largest collateral asset pledged, in terms of gross exposure. Robust standard errors (clustered daily) in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% level, respectively.

Results in Table 5 show that after controlling for bank, date and collateral types, margin requirements exhibit a similar pattern as in Figure 4. The coefficients associated with the balanced portfolio dummy are both statistically and economically significant across multiple specifications, indicating that net exposures play an important role in determining margin requirements. The negative sign of the coefficient suggests that more balanced positions generally require less margin, which is consistent with our previous investigation. Column (1) in Table 5 presents estimates based on the full sample, which includes all market segments. These results indicate that balanced portfolios are, on average, associated with margin requirements approximately 0.8 percentage points lower than those applied to unbalanced portfolios. The effect is stronger for centrally cleared repo positions, which may also reflect the higher prevalence of balanced portfolios in that segment, as noted in the previous section.

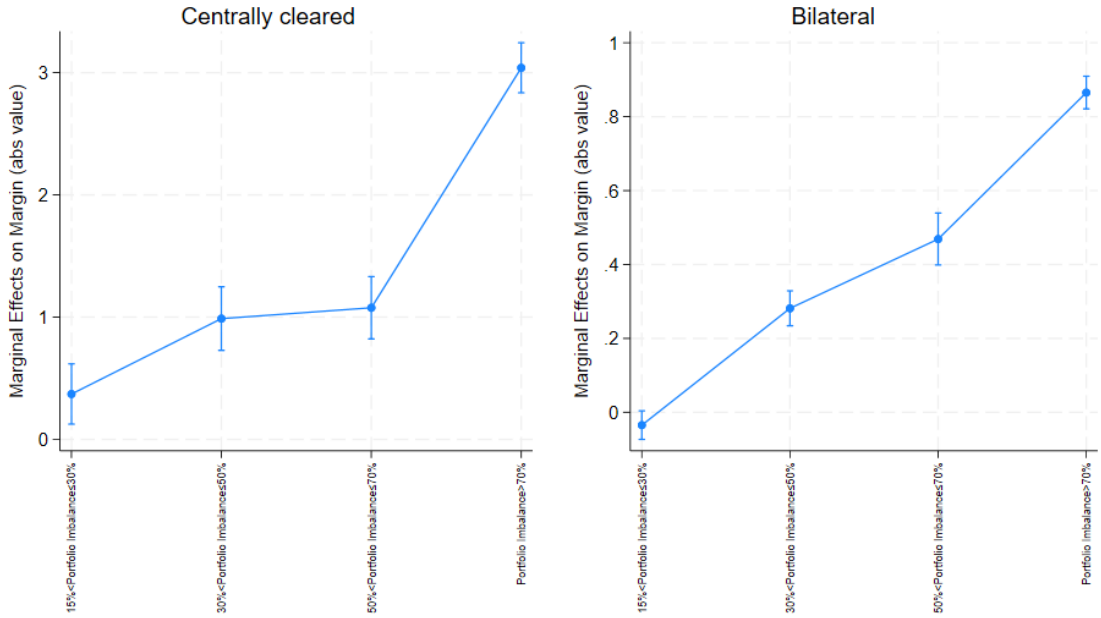
Table 6: Absolute Margin and Portfolio Imbalance

Dep. variable: Absolute Margin (%)	(1) Centrally cleared	(2) Bilateral	(3) Bilateral: Interbank	(4) Bilateral: Bank-to-NonBank
1(15<Portfolio Imbalance≤ 30)	0.371***	-0.035*	-0.179***	0.045**
	(0.126)	(0.020)	(0.031)	(0.018)
1(30<Portfolio Imbalance≤ 50)	0.988***	0.282***	0.071**	0.278***
	(0.133)	(0.024)	(0.035)	(0.022)
1(50<Portfolio Imbalance≤ 70)	1.077***	0.469***	0.287***	0.369***
	(0.130)	(0.036)	(0.049)	(0.029)
1(Portfolio Imbalance>70)	3.040***	0.865***	0.791***	0.456***
	(0.104)	(0.023)	(0.027)	(0.019)
Bank FE	Yes	Yes	Yes	Yes
Counterparty FE	No	Yes	Yes	Yes
Date FE	Yes	Yes	Yes	Yes
Collateral FE	Yes	Yes	Yes	Yes
Observations	113042	7331174	1694552	5695281
Adjusted R^2	0.31	0.33	0.30	0.38

Note: The dependent variable is the absolute margin exchanged, in percentage of gross exposure. Collateral FE represent the largest collateral asset pledged, in terms of gross exposure. Robust standard errors (clustered daily) in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% level, respectively.

To further explore the marginal effect of portfolio imbalance on margin requirements and capture potential non-linearities, we estimate an alternative specification including dummy variables for different imbalance thresholds: net exposure exceeding 30%, 50%, and 70% of the respective repo gross positions. The results, reported in Table 6, reveal a non-linear relationship, with highly unbalanced portfolios that attract margin requirements up to approximately 3 percentage points higher than balanced positions.

Figure 5: Marginal effects of portfolio imbalance



Note: Marginal effects of $PortfolioImbalance$ on absolute margin, by centrally-cleared and bilateral segment. Based on estimation shown in Table 6. Error bars represent 95% confidence intervals.
Source: SFTR, authors' calculations.

Figure 5 illustrates these findings more clearly and contrasts the patterns between centrally and bilaterally cleared markets. Unbalanced positions in the centrally cleared segment tend to require substantially higher additional resources than balanced positions within the same segment, as well as similar positions in the bilateral market. At the same time, our results highlight the benefits of broader central clearing. By consolidating multiple positions through a single counterparty, central clearing enhances netting benefits and makes it easier to achieve more balanced portfolios (within the same clearing node). This facilitates risk compression and reduces margin requirements. Such benefits would be difficult to obtain if the same trading positions are fragmented across a diverse set of bilateral counterparties.

Furthermore, the lower requirements observed for bilateral portfolios, even in the case of unbalanced positions, may suggest that components such as the initial margin (IM) are less strongly reflected in margin requirements in this segment (see Section 3 for further discussion). As a result, margin levels may be primarily driven by the variation margin (VM) component. In addition, favourable market conditions may further reduce the total margin posted, as counterparties may perceive lower risk and adjust requirements accordingly, while also receiving margin payments depending on short-term market fluctuations.

7. Volatility, market stress and margin dynamics

Section 7 discusses the role of risk factors in determining repo margins, with a particular focus on comparative analysis between segments. In particular, Section 7.1 evaluates, from a structural perspective, the relevance of risk factors capturing volatility through different dimensions (i.e. short and long-term). Next, Section 7.2 focuses on margin dynamics during recent episodes of significant collateral price fluctuations affecting relevant collateral assets in our sample.

7.1. Volatility

In this section, we explore the relationship between margins and collateral volatility, drawing from the risk metrics defined in Section 4.2. We test Hypothesis 4 by estimating the panel FE regressions defined in Eq. (10), which include bank, counterparty and collateral fixed-effects.

$$Margin^{\%}_{ijt} = \alpha_i + \delta_j + \gamma_c + \beta_1 Volatility_{t-1} + \beta_2 1D\ Delta\ Yield_{t-1} + \epsilon_{ijt} \tag{10}$$

In terms of dependent variables and FE, the setting is analogous to the one described in Section 5 - with the main difference being the addition of FEs for both counterparties, and the removal of time FEs to allow for the time-variant volatility to be included. In addition, we employ three different measures for the *Volatility* variable. We selected the volatility of government bond yields for Germany, the United Kingdom, and the United States. We choose the volatility measure on German sovereign yields as a proxy for the EU area. We adopt the same approach for the other risk metric considered in the analysis (*1D Delta Yield*). Daily yield changes capture immediate market movements and primarily affect variation margins, while rolling standard deviation reflects longer-term volatility shifts and market uncertainty that more strongly influence initial margins. We adopt both variables in the analysis since, together, these factors reveal how short-term fluctuations and longer-term volatility patterns interact to determine margin requirements in a market characterised by the use of fixed income collateral. We employ the lag of these measures to avoid reverse causality issues, as past volatility is likely not influenced by current margin requirements; in addition, this reflects also standard margin-setting mechanisms, which often incorporate historical volatility measures when determining current requirements.

Table 7: Risk factors across market segments

	Cleared			Bilateral: Interbank			Bilateral: Bank-to-NonBank		
Dep. variable: Absolute Margin (%)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DE vol (lag)	0.149***			0.056***			0.036***		
	(0.012)			(0.009)			(0.003)		
DE Delta Yield (lag abs)	0.010			0.012***			0.003**		
	(0.007)			(0.004)			(0.001)		
UK vol (lag)		0.103***			0.058***			0.028***	
		(0.011)			(0.004)			(0.002)	
UK Delta Yield (lag abs)		0.004			0.009***			0.003***	
		(0.005)			(0.003)			(0.001)	
US vol (lag)			0.150***			0.101***			0.044***
			(0.016)			(0.010)			(0.004)
US Delta Yield (lag abs)			0.005			0.008**			0.001
			(0.006)			(0.004)			(0.001)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Counterparty FE	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Collateral FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Margin sign FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	113880	113880	113880	1695006	1695006	1695006	5701650	5701650	5701650
Adjusted R^2	0.30	0.30	0.30	0.32	0.32	0.32	0.41	0.41	0.41

Note: The dependent variable is the absolute margin exchanged, in percentage of gross exposure. Collateral FE represent the largest collateral asset pledged, in terms of gross exposure. Robust standard errors (clustered daily) in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% level, respectively.

Table 7 shows regression results for the risk factors in our model across market segments. The regressions are estimated in each of the following subsamples: the centrally cleared one (columns (1) to (3)), the bilateral interbank ((4) to (6)), and the bank-to-nonbank one ((7) to (9)). As expected, the rolling *Volatility* variables are positively correlated with the size of the margin exchanged. Notably, this correlation appears stronger in the centrally cleared segment, regardless of the country proxy used, and weakest in the Bank-to-NonBank segment. To assess the economic significance of these relationships, a one standard deviation increase in German bond volatility leads to a 0.33 percentage points increase in centrally cleared margins.[16] In comparison, the same volatility increase is associated with smaller

[16]This value was computed as 0.149*2.23, which is the standard deviation of yield volatility for German government bonds in our sample.

effects in other market segments: a 0.12 percentage point rise in interbank repo margins and a 0.08 percentage point increase in bank-to-non-bank repo margins.

Considering the second risk metric used, the absolute value of *1D Delta Yield* is not statistically significant in CCP-cleared repo transactions, while it generally displays a positive and significant correlation in the bilateral segment. We relate these findings to the different volatility patterns of the risk metrics employed: due to the different risk management practices, it is likely that margins in the centrally cleared segment greatly incorporate the IM component, and are thus more strongly correlated with longer-term volatility measures, as discussed in Section 3. Conversely, the correlation identified with the *1D Delta Yield* variable, which captures short-term price fluctuations, suggests that margins in bilateral repo portfolios could be more reactive to extreme shocks via margin calls, while less influenced by the IM-type component. To better understand margin dynamics under tail scenarios, the next section explores potential nonlinearities in margin requirements by examining recent episodes of collateral price volatility within our sample.

7.2. Margin dynamics in tail events

In this section, we turn our attention to margin dynamics following significant fluctuations in collateral prices. Investigating how margin requirements respond to episodes of heightened market volatility is crucial for evaluating the potential procyclical effects of margining, as well as its role in preserving market liquidity and stability. We focus on government bonds, the primary collateral type in both European Economic Area (EEA) and global repurchase agreement markets, and analyse two notable price shock episodes within our sample period: the UK gilt market disruption in late 2022 and the pronounced yield adjustment in eurozone sovereign debt markets that followed European fiscal policy developments in March 2025 (Figure A.5). Gilt yields spiked in September 2022 in response to the Chancellor's announcement of an expansionary fiscal package that included major tax cuts without corresponding funding measures (Pinter (2023)). The second episode primarily affected the EEA sovereign bond markets in early March 2025, when yields increased sharply following Germany's announcement of a planned fiscal expansion and higher defence spending. In particular, German yields surged dramatically, climbing 40 basis points in two days to reach historical highs (ESMA (2025)).

Table 8: Margin dynamics under tail events

	Full sample			Subsample: EU & UK sov. collateral		
	Cleared	Bilateral: Interbank	Bilateral: Bank-to-NonBank	Cleared	Bilateral: Interbank	Bilateral: Bank-to-NonBank
Dep. variable: Absolute Margin (%)	(1)	(2)	(3)	(4)	(5)	(6)
DE vol (lag)	0.096***	0.026**	0.028***	0.086***	0.055***	0.032***
	(0.014)	(0.010)	(0.004)	(0.017)	(0.011)	(0.006)
UK vol (lag)	0.062***	0.063***	0.026***	-0.006	0.056***	0.074***
	(0.012)	(0.005)	(0.003)	(0.009)	(0.007)	(0.006)
5bp < UK Delta Yield < 10bp	0.022	0.023	0.014	0.036	0.128**	0.022
	(0.064)	(0.049)	(0.012)	(0.075)	(0.053)	(0.018)
10bp < UK Delta Yield < 15bp	0.205*	0.064	0.034*	0.302**	-0.076	0.071*
	(0.115)	(0.072)	(0.020)	(0.129)	(0.081)	(0.038)
15bp < UK Delta Yield < 30bp	-0.015	0.160*	0.087**	-0.096	0.169	0.143*
	(0.129)	(0.093)	(0.037)	(0.163)	(0.108)	(0.075)
UK Delta Yield > 30bp	-0.191***	0.871***	0.301***	-0.158	0.809***	0.691***
	(0.067)	(0.033)	(0.028)	(0.098)	(0.042)	(0.048)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Counterparty FE	No	Yes	Yes	No	Yes	Yes
Collateral FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	113891	1663410	5733033	38349	277280	2200298
Adjusted R^2	0.30	0.29	0.38	0.48	0.46	0.37

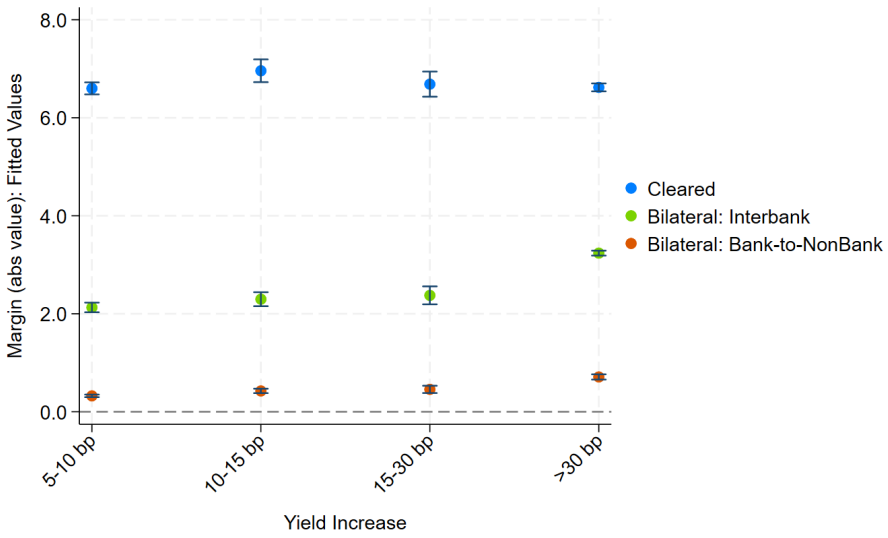
Note: The dependent variable is the absolute margin exchanged, in percentage of gross exposure. Collateral FE represent the largest collateral asset pledged, in terms of gross exposure. Robust standard errors (clustered daily) in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% level, respectively.

Both episodes involved substantial increases in sovereign yields, which depreciated the value of government bonds serving as repo collateral. We capture these yield movements through our *Delta Yield* variable; in particular, we identify extreme yield increases through dummy variables with thresholds at 5, 10, 15, and 30 basis points in the right tail of the distribution. We examine margin behaviour in the presence of pronounced yield fluctuations using a regression framework similar to Eq. (10). Table 8 presents results for UK sovereign

yield movements. We chose the UK yield as a representative example, because (i) it shows a wide variability in the period of analysis, and (ii) relatedly, the previous risk factor analysis identified it as the one with the highest statistical significance between segments (see Table 7). However, the results in Table 8 do not specifically focus on Gilt collateral or repo exposures between UK entities; rather, we use it as a general factor, while we examine more in-depth UK and EU collateral (and their respective risk factors) at a later stage. A similar investigation was conducted using extreme movements in German sovereign yields, though the results were less significant, likely due to the more limited yield volatility observed for this factor over the sample period.[17]

In this setting, the benchmark category contains the observations corresponding to delta yield increases below 5 bps. Columns (1) to (3) are the results of the regression estimated over the full sample, while columns (4) to (6) refer to a sub-sample that contains only portfolios backed by EU and UK sovereign collateral. A key finding from the bilateral segments is that, after controlling for bank, counterparty, and collateral FE, margin adjustments exhibited a pronounced non-linear relationship, responding robustly only to the largest yield movements, while showing subdued responses to more moderate volatility changes. Compared to the benchmark, the tail of the UK yield distribution ($UK\ Delta\ Yield > 30bp$) is associated with a statistically significant increase in absolute margins exchanged of almost 0.9 and 0.3 percentage points in the interbank and in the bank-to-nonbank segments, respectively. When focusing on the EU & UK collateral subsample, these numbers amount to 0.8 and 0.7 percentage points. This represents a notable increase, particularly given the relatively low margin levels observed in these segments (as highlighted in 5.1). In contrast, the margins in the centrally cleared segment remained relatively insensitive to yield changes. For easier interpretation of the economic significance, Figure 6 displays the average predicted margins corresponding to yield tail events.[18]

Figure 6: Fitted values of Absolute Margin (full sample)



Note: Average predicted value of absolute margin exchanged, in percentage of gross exposure, based on the panel FE regression shown in Table 8. Colours represent different market segments.
Source: SFTR, authors' calculations.

[17]We also generally avoid including yield changes from multiple sovereign issuers simultaneously in our models to mitigate potential multicollinearity, as yield movements across countries can be correlated, which may bias our estimates.

[18]The fitted values are based on the panel FE regression shown in Table 8, specifically on the full sample estimation - columns (1) to (3).

The preceding analysis used the entire data sample, without selecting a specific collateral class. To validate our findings on margin dynamics in tail scenarios, we now focus on portfolios collateralised by EU and UK sovereign bonds. We examine whether country-specific risk factors have differential effects on margin requirements in response to heightened volatility. Table 9 presents results for nonbank borrowers - a subset of particular interest, given the increasing role of NBFIs in sovereign bond and repo markets, and the significant implications for market functioning, liquidity, and related policy considerations.[19] Results for other subsets, focusing on different market segments, are available upon request.

To understand the direction of the margin exchange, we employ net margins as a dependent variable.

Table 9: Bilateral: Bank lender to NonBank borrower

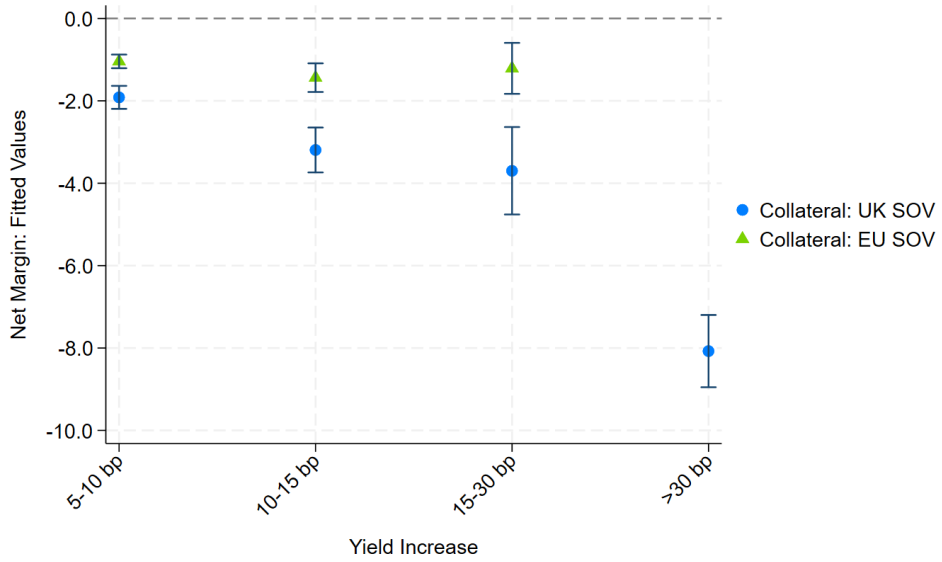
	(1)	(2)
Dep. variable: Net Margin (%)	UK sov. collateral	EU sov. collateral
UK vol (lag)	-0.502***	
	(0.032)	
DE vol (lag)		-0.121***
		(0.016)
5bp < UK Delta Yield < 10bp	-0.111	
	(0.138)	
10bp < UK Delta Yield < 15bp	-0.475*	
	(0.257)	
15bp < UK Delta Yield < 30bp	-0.986*	
	(0.533)	
UK Delta Yield > 30bp	-4.196***	
	(0.473)	
5bp < DE Delta Yield < 10bp		-0.057
		(0.085)
10bp < DE Delta Yield < 15bp		-0.245
		(0.179)
15bp < DE Delta Yield < 30bp		0.018
		(0.319)
Bank FE	Yes	Yes
Counterparty FE	Yes	Yes
Collateral FE	Yes	Yes
Observations	215653	131976
Adjusted R^2	0.33	0.25

Note: The dependent variable is the net margin exchanged, in percentage of gross exposure. Collateral FE represent the largest collateral asset pledged, in terms of gross exposure. Robust standard errors (clustered daily) in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% level, respectively.

The results from column (1) - i.e. those related to portfolios backed by UK sovereign bonds - confirm our earlier findings on non-linear margin responses: following significant yield fluctuations, banks received margin payments from non-bank counterparties that were 4.2 percentage points higher than in normal market conditions. At the same time, no such increase was observed for portfolios backed by EU sovereign collateral, in correspondence with moderate yield increases. This is clearly observed graphically in Figure 7, where we show the average fitted values in the different tail scenarios. The results remain qualitatively similar if one differentiates between the most represented sovereign portfolios in our sample (DE, FR, IT), albeit with some heterogeneity; a visual inspection is provided in Figure A.6.

[19]For more details on the ongoing policy discussion, see FSB (2022) and related works examining the rising participation of NBFIs in sovereign bond markets and analysing their trading behaviour, including Eren and Wooldridge (2021), Timmer (2018), Czech and Roberts-Sklar (2019), Panzarino (2022), among others.

Figure 7: Fitted values of Net Margin (Bank lender to NonBank borrower)



Note: Average predicted value of net margin exchanged, in percentage of gross exposure, by collateral type. Based on the panel FE regression shown in Table 9. Positive (negative) fitted values represent margin posted (received) by the reporting bank. The subsample considered includes only trades where a Bank lends to a NonBank borrower. *Source:* SFTR, authors' calculations.

An important difference between the two settings is that the proxy for EU short-term yield volatility (*DE Delta Yield*) did not experience a change greater than 30bp during the analysis period. In contrast, UK yields saw increases above 30bp in our timeframe, mostly during the 2022 mini-budget crisis (Figure A.4). Thus, in a first instance, the sheer size of the collateral repricing was larger in the latter episode. Second, the 2022 mini-budget crisis saw a sharp yield rise which caused deleveraging[20] (notably by LDI and pension funds), ultimately leading to a severe deterioration of liquidity in Gilt markets (Bank of England (2025b)). Interestingly, when distinguishing between non-bank borrower types, our results are consistent with this narrative; namely, the strongest effects on margins paid are those for ICPFs and EEA investment funds (Table A.6), which include, in our sample, LDI funds domiciled in the EEA.[21] On the other hand, considering the March 2025 yield spike, it is important to underline that no liquidity impact was observed for EU sovereign bonds, despite the notable, yet short-lived, increase in yields. To our knowledge, there is also no comparable evidence of significant deleveraging behaviour at that time, which would otherwise have triggered feedback loops affecting sovereign bond prices and liquidity. This difference may help explain the more muted response of bilateral margins during the euro area yield adjustment in March 2025.

Overall, the results in this section indicate that margins respond proportionally to collateral volatility, supporting Hypothesis 4. However, this response differs across segments: centrally cleared transactions show more pronounced adjustments to medium-term volatility, whereas bilateral transactions tend to react more to short-term yield changes and experience amplified, non-linear margin responses during periods of greater market volatility.

[20] Cf. Pinter (2023) for a detailed description of the 2022 Gilt market stress.

[21] Cf. ESRB (2023) for an in-depth analysis of the LDI stress in 2022, including how EEA trade repository data contains useful information on the event.

8. Conclusion

Margins exchanged to support financial transactions play a crucial role in maintaining financial stability. By creating liquidity buffers within the system, they protect market participants from adverse price movements, improve the capacity to absorb shocks, and enhance overall market resilience. However, if not properly calibrated, margins may be subject to abrupt adjustments during periods of market stress, which can heighten liquidity risks and exacerbate financial instability.

Despite their importance, there is limited empirical evidence on margin practices in the repo market, and particularly in less transparent segments, such as bilateral transactions. This paper uses newly available regulatory data in the EEA to examine margin practices in both centrally and bilaterally cleared segments, providing a comprehensive overview of the main margin drivers and empirically testing their relevance. The methodological approach adopted in this study provides a more complete overview of margining practices and underlines the importance of employing a comprehensive set of metrics when analysing the bilateral and the centrally cleared market segments.

We identify three key findings. First, margin patterns vary significantly across market segments and counterparty sectors. On average, bilateral markets exhibit substantially lower margin levels than centrally cleared trades, even after controlling for collateral types and counterparty characteristics. Regarding margin flows, while CCPs collect margins from both counterparties in centrally cleared transactions, bilateral markets display substantial heterogeneity. Banks generally post margins when acting as net cash borrowers. However, when dealing with non-bank counterparties, banks are less likely to post margins and may even receive them while in a borrowing position. This asymmetry likely reflects differences in relative risk profiles and the structure of bilateral networks between banks and non-bank entities. Second, portfolio netting emerges as a key determinant of margin requirements, particularly in centrally cleared markets. More balanced portfolios are associated with lower margins, while highly unbalanced positions attract, on average, margins up to 3 percentage points higher. These results highlight the role of net exposures in shaping margin requirements, suggesting a more accurate reflection of counterparty risk and supporting more efficient collateral allocation. Third, volatility dynamics play an important role in margin setting. We find proportionate adjustments to medium-term volatility, strongest in centrally cleared repos. Short-term volatility has a greater impact on bilateral margins, indicating heightened sensitivity to immediate price movements. We also identify non-linear responses of margin requirements during episodes of significant price fluctuations included in our sample. Margins in the non-centrally cleared segment showed pronounced adjustments during the UK sovereign yield stress episode in 2022, while no comparable effects occurred during the euro area yield correction in March 2025. This likely reflects differences in the magnitude of yield movements, deleveraging dynamics, and collateral liquidity across the two episodes.

From a financial stability angle, our findings have several implications. Portfolio-level margining plays a critical role in both centrally cleared and bilateral markets, highlighting the benefits of portfolio diversification in mitigating risk and reducing margin requirements. In bilateral markets, as discussed in our analytical framework and related studies (Kahn and McCormick (2025)), the absence of a trusted third-party responsible for collecting margins can generate asymmetric protection, leaving counterparties unevenly exposed to credit risk. Furthermore, the relatively low margin requirements observed in bilateral repo transactions reduce the capital needed to support trading positions, thereby increasing leverage risks - consistent with evidence linking low haircut levels to elevated leverage among non-bank financial institutions (Banegas and Monin (2023)).

Future research should combine trade-level haircut data with net exposure information, in order to obtain a holistic view of margining practices in bilateral repo markets.

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A. Data preparation and cleaning

Due to the complexity and the size of the data employed, various methodological choices and data cleaning procedures were applied.

- **Filtering:** We focus on the period between 1 June 2022 and 1 June 2025, and we include only the three major currencies present in SFTR (i.e. EUR, USD and GBP-denominated repos), representing about 93% of overall repo outstanding amounts by entities domiciled in the European Economic Area (ESMA (2024)). From a maturity dimension, we consider as outstanding repos that have been executed and have not yet matured (e.g. the return leg of the repo has not been settled). Thus, when computing counterparty pair exposures we exclude both matured and forward repos. In addition, to facilitate the interpretation of the results and to avoid double-counting of centrally cleared trades, we take the perspective of reporting banks from the EEA. Thus, we exclude transactions reported by CCPs and other non-bank entities. This implies, in practice, that our reporting counterparties are all banks, engaging in repo and reverse repo trades with many different types of counterparties (e.g. CCPs, other banks, investment funds, pension funds, etc.). Additionally, when selecting margin data, we prioritize the reports by EEA CCPs where available, due to data quality considerations. We then assign the centrally cleared margins reported by EEA CCPs to their counterparties, since we exclude exposures reported by CCPs in our analysis. The analysis includes margins data relative to CCPs who clear repo trades with EEA-domiciled counterparties.[22]

- **Data cleaning:** First, we remove potential duplicates by using a composite key approach (based on reporting counterparty, other counterparty, trade identifier, collateral ISIN and execution timestamp). Similarly, when cleaning bilateral margin data, we keep only one margin report per counterparty pair, currency and event date, where multiple ones are available. Second, we remove term repos without a maturity date and records with implausible collateral-to-loan values.[23] Third, we exclude trade-level observations with abnormally large principal and collateral amounts by applying a threshold of EUR 50 bn. We also exclude records with reported margin values greater than EUR 10 bn (2 bn) for the centrally cleared (bilateral) segment. Fourth, we address extreme values through winsorization and conduct comprehensive data validation through extensive manual verification. Finally, we further restrict our sample by excluding observations corresponding to market closures due to European public holidays.

- **Collateral classification:** Starting from the validated data reported in SFTR, we classify the securities according to their asset type and to the jurisdiction of the issuer. The collateral classification can be visualised in Figure A.1 and Figure A.2.[24] In a second step, we assign to each portfolio the asset classification of the most representative collateral asset exchanged between a pair of entities at a specific time.

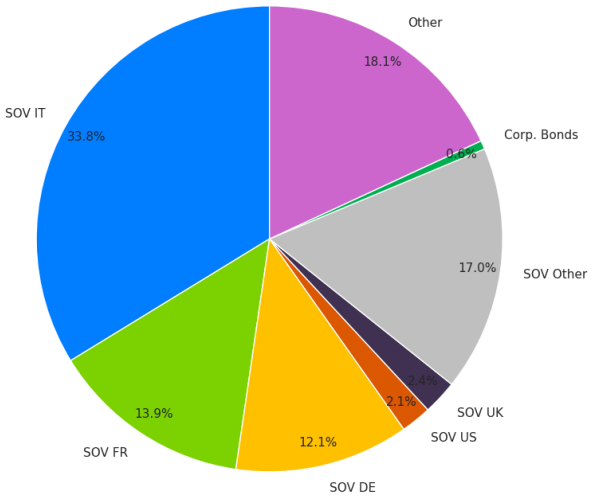
[22] More information on which CCPs offer clearing services in the EEA is available at ESMA's List of Central Counterparties authorised to offer services and activities in the Union.

[23] For the implementation of the collateral-to-loan ratio, we follow the approach described in ESMA (2024).

[24] To note, the category "Other" includes collateral that we are not able to classify, either because the portfolios are highly diversified, differ from the previously defined categories, or because collateral information is missing.

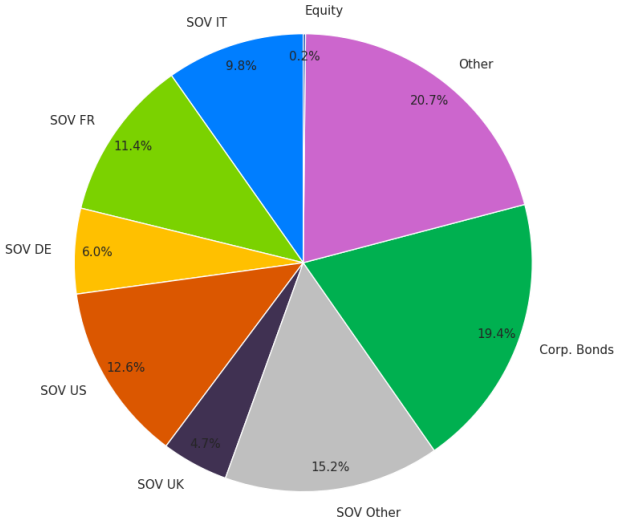
B. Additional Tables and Figures

Figure A.1: Portfolio classification by collateral type - centrally cleared segment



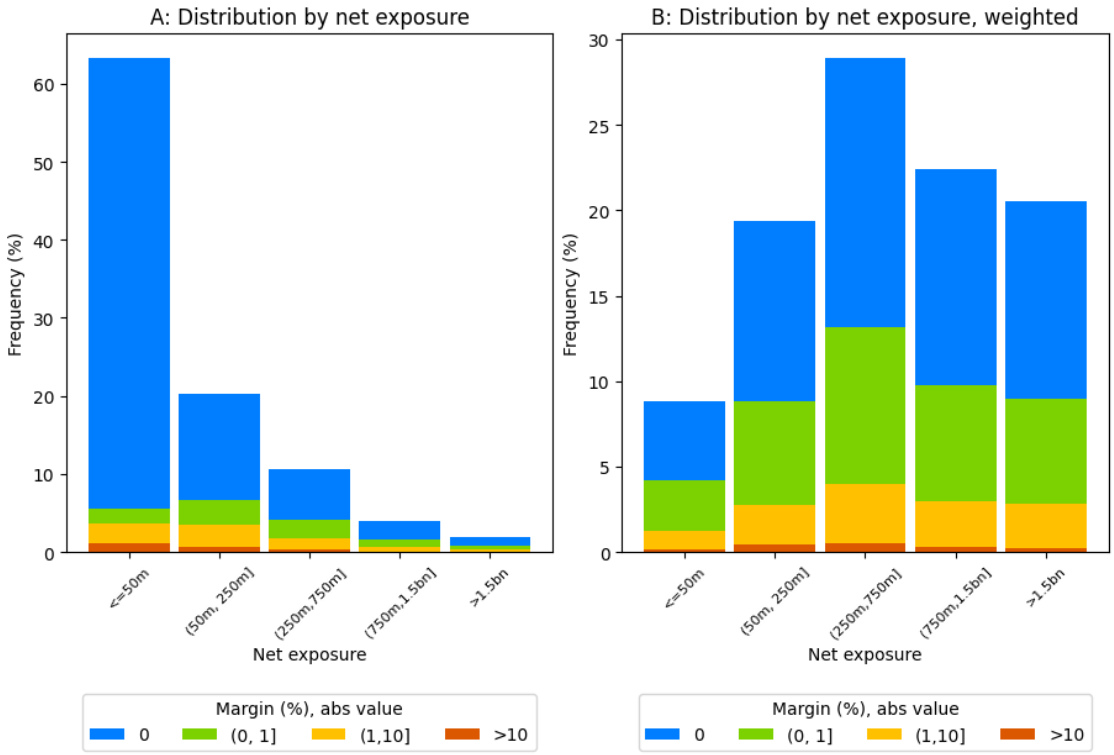
Note: Total outstanding amounts in centrally cleared repo, by collateral type (daily average).
Source: SFTR, authors' calculations.

Figure A.2: Portfolio classification by collateral type - bilateral segment



Note: Total outstanding amounts in bilateral repo, by collateral type (daily average).
Source: SFTR, authors' calculations.

Figure A.3: Distribution of bilateral repo portfolios by net exposure

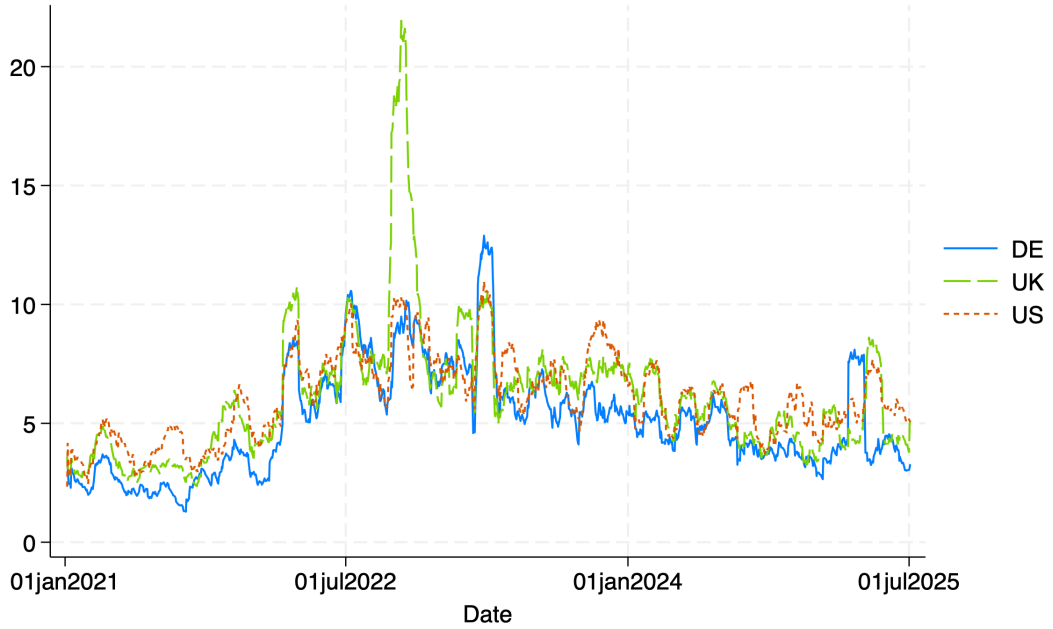


Note: Distribution of end-of-day bilateral repo portfolios by margin level and net exposure buckets. Panel A shows a simple distribution of records, while Panel B shows the same distribution, weighted by the gross repo exposure. Weekly sampling frequency.
Source: SFTR, authors' calculations.

Figure A.4: Sovereign yield

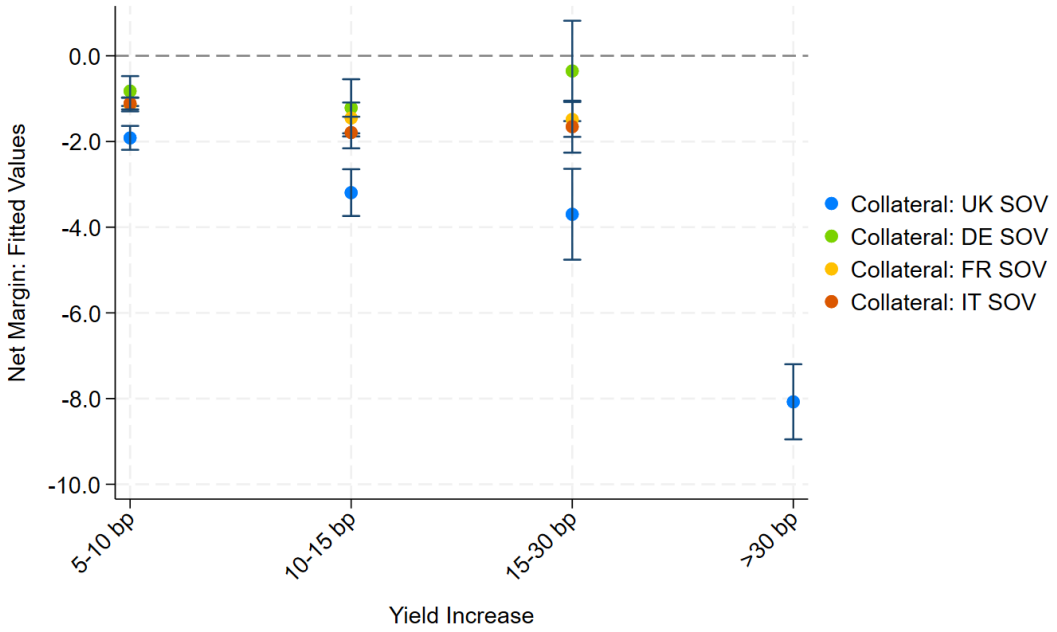
Note: Yields on 10Y sovereign bonds, in %.
Source: Refinitiv Datastream.

Figure A.5: Sovereign yield volatility



Note: Volatility of 10Y sovereign bond yields, computed as the 22-day rolling standard deviation of daily yield changes.
Source: Refinitiv Datastream, authors' calculations.

Figure A.6: Fitted values of Net Margin (Bank lender to NonBank borrower)



Note: Average predicted value of absolute margin exchanged, in percentage of gross exposure, by collateral type. Based on the panel FE regression shown in Table A.5. The subsample considered includes only trades where a Bank lends to a NonBank borrower.
Source: SFTR, authors' calculations.

Table A.1: Zero Margin Probability

Dep. variable: 1(Margin = 0)	(1)	(2)	(3)	(4)	(5)	(6)
	Full sample	Full sample	Bank lender	Bank lender	Bank borrower	Bank borrower
Bilateral	0.646***	0.607***	0.566***	0.550***	0.699***	0.642***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)
Bilateral: Bank-to-NonBank		0.123***		0.050***		0.190***
		(0.001)		(0.001)		(0.001)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Date FE	Yes	Yes	Yes	Yes	Yes	Yes
Collateral FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7510852	7510852	1931240	1931240	5579601	5579601
Adjusted R^2	0.52	0.53	0.40	0.40	0.59	0.61

Note: The dependent variable is an indicator variable, representing the probability of zero margin exchanged. Collateral FE represent the largest collateral asset pledged, in terms of gross exposure. Robust standard errors (clustered daily) in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% level, respectively.

Table A.2: Fitted values of Net Margin, by bank position and segment

Bank side	Market segment	Fitted values (mean)	Std. Dev.	Lower CI	Upper CI	N
Borrowing	Centrally cleared	6.68	0.04	6.61	6.75	78,606
Borrowing	Bilateral: Interbank	0.49	0.02	0.46	0.52	838,386
Borrowing	Bilateral: Bank-to-NonBank	-0.05	0.00	-0.06	-0.04	4,662,620
Lending	Centrally cleared	7.37	0.07	7.25	7.50	35,276
Lending	Bilateral: Interbank	-0.95	0.01	-0.97	-0.94	856,654
Lending	Bilateral: Bank-to-NonBank	-1.05	0.01	-1.06	-1.04	1,039,327

Note: The table shows the average predicted value of the net margin exchanged, in percentage of gross exposure, based on the panel FE regression shown in Table 3. Positive (negative) fitted values represent margin posted (received) by the reporting bank. Collateral FE represent the largest collateral asset pledged, in terms of gross exposure. Robust standard errors (clustered daily) in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% level, respectively.

Table A.3: Non-bank counterparties

Dep. variable: Net Margin (%)	(1)	(2)	(3)	(4)	(5)	(6)
	ICPF	EEA Inv. Fund	Foreign Inv. Fund	MMF	OFI	Other
Rep Bank Lender	0.376***	-1.055***	-0.108***	0.000	-0.300***	-0.336***
	(0.076)	(0.061)	(0.017)	(.)	(0.056)	(0.049)
Constant	-1.241***	-0.245***	-0.035***	0.014***	-0.252***	-0.025***
	(0.047)	(0.020)	(0.011)	(0.000)	(0.024)	(0.003)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Counterparty FE	Yes	Yes	Yes	Yes	Yes	Yes
Date FE	Yes	Yes	Yes	Yes	Yes	Yes
Collateral FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	369766	692121	443970	29397	210447	3987328
Adjusted R^2	0.24	0.47	0.07	0.08	0.36	0.36

Note: The dependent variable is the net margin exchanged, in percentage of gross exposure. The subsample considered includes only the Bank-to-NonBank segment, split by the sector of the non-bank counterparty (in column titles). $ICPF$ = Insurance Corporations & Pension Funds, MMF = Money Market Fund, OFI = Other Financial Institutions. Collateral FE represent the largest collateral asset pledged, in terms of gross exposure. Robust standard errors (clustered daily) in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% level, respectively.

Table A.4: Portfolio Imbalance by counterparty sector

Dep. variable: Abs Margin (%)	(1) Bank	(2) ICPF	(3) EEA Inv. Fund	(4) Foreign Inv. Fund	(5) MMF	(6) OFI	(7) Other
1(15<Portfolio Imbalance≤ 30)	-0.179***	0.671***	-0.403***	0.072***	-0.869***	0.124***	-0.421***
	(0.031)	(0.093)	(0.115)	(0.009)	(0.106)	(0.043)	(0.125)
1(30<Portfolio Imbalance≤ 50)	0.071**	0.128	0.911***	0.175***	0.046	0.291***	0.036
	(0.035)	(0.080)	(0.099)	(0.018)	(0.075)	(0.062)	(0.083)
1(50<Portfolio Imbalance≤ 70)	0.287***	0.444***	0.390***	0.266***	-0.060	0.515***	0.481***
	(0.049)	(0.077)	(0.126)	(0.024)	(0.047)	(0.067)	(0.147)
1(Portfolio Imbalance>70)	0.791***	0.793***	0.723***	0.188***	0.193***	0.288***	0.105***
	(0.027)	(0.059)	(0.042)	(0.019)	(0.040)	(0.063)	(0.014)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Counterparty FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Date FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Collateral FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1694552	377165	693213	443875	29400	165141	3986483
Adjusted R^2	0.30	0.30	0.54	0.22	0.16	0.33	0.41

Note: The dependent variable is the absolute margin exchanged, in percentage of gross exposure. The subsample considered includes only the non-centrally cleared segment, split by the counterparty sector. $ICPF$ = Insurance Corporations & Pension Funds, MMF = Money Market Fund, OFI = Other Financial Institutions. Collateral FE represent the largest collateral asset pledged, in terms of gross exposure. Robust standard errors (clustered daily) in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% level, respectively.

Table A.5: Non-bank borrowers by sovereign collateral type

	Bilateral: Bank lender to NonBank borrower				
	UK sov. collateral	EU sov. collateral	DE sov. collateral	FR sov. collateral	IT sov. collateral
Dep. variable: Net Margin (%)	(1)	(2)	(3)	(4)	(5)
UK vol (lag)	-0.502***				
	(0.032)				
DE vol (lag)		-0.121***	0.014		
		(0.016)	(0.039)		
FR vol (lag)				-0.158***	
				(0.016)	
IT vol (lag)					-0.149***
					(0.009)
5bp < UK Delta Yield < 10bp	-0.111				
	(0.138)				
10bp < UK Delta Yield < 15bp	-0.475*				
	(0.257)				
15bp < UK Delta Yield < 30bp	-0.986*				
	(0.533)				
UK Delta Yield > 30bp	-4.196***				
	(0.473)				
5bp < DE Delta Yield < 10bp		-0.057	-0.178	0.032	-0.162**
		(0.085)	(0.174)	(0.083)	(0.071)
10bp < DE Delta Yield < 15bp		-0.245	-0.593*	-0.017	-0.475**
		(0.179)	(0.337)	(0.187)	(0.187)
15bp < DE Delta Yield < 30bp		0.018	0.263	-0.024	-0.488
		(0.319)	(0.598)	(0.212)	(0.310)
DE Delta Yield > 30bp		0.000	0.000	0.000	0.000
		(.)	(.)	(.)	(.)
Bank FE	Yes	Yes	Yes	Yes	Yes
Counterparty FE	Yes	Yes	Yes	Yes	Yes
Collateral FE	Yes	Yes	Yes	Yes	Yes
Observations	215653	131976	31134	74078	26727
Adjusted R^2	0.33	0.25	0.05	0.30	0.52

Note: The dependent variable is the net margin exchanged, in percentage of gross exposure. The subsample considered includes only NonBank borrowers, split by sovereign collateral (in column titles). EU collateral includes DE, FR and IT sovereign collateral. Collateral FE represent the largest collateral asset pledged, in terms of gross exposure. Robust standard errors (clustered daily) in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% level, respectively.

Table A.6: Borrowers exposed to UK sovereign collateral

Dep. variable: Net Margin (%)	(1) Bank	(2) ICPF	(3) EEA Inv. Fund	(4) Foreign Inv. Fund	(5) OFI	(6) Other
UK vol (lag)	-0.193***	-0.448***	-0.592***	0.050***	0.106***	-0.309***
	(0.017)	(0.028)	(0.038)	(0.014)	(0.019)	(0.025)
5bp < UK Delta Yield < 10bp	-0.291**	-0.146	-0.095	-0.056	-0.110	-0.112
	(0.120)	(0.128)	(0.169)	(0.132)	(0.125)	(0.128)
10bp < UK Delta Yield < 15bp	-0.042	-0.598**	-0.412	-0.624**	-0.470**	-0.338
	(0.192)	(0.242)	(0.315)	(0.256)	(0.216)	(0.205)
15bp < UK Delta Yield < 30bp	-0.399*	-1.201**	-0.947	-0.675**	-0.702*	-0.553
	(0.238)	(0.535)	(0.632)	(0.270)	(0.382)	(0.337)
UK Delta Yield > 30bp	-1.877***	-3.999***	-4.501***	0.258	0.000	-3.301***
	(0.600)	(0.689)	(0.422)	(0.401)	(.)	(0.301)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Counterparty FE	Yes	Yes	Yes	Yes	Yes	Yes
Collateral FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9149	66708	114413	11019	904	22609
Adjusted R^2	0.34	0.25	0.34	0.36	0.32	0.46

Note: The dependent variable is the net margin exchanged, in percentage of gross exposure. The subsample considered includes only borrowers exposed to UK sovereign collateral, split by counterparty type (in column titles). Collateral FE represent the largest collateral asset pledged, in terms of gross exposure. Robust standard errors (clustered daily) in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% level, respectively.

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