The International Dimension of Repo: Five New Facts*

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Abstract

We analyze the international dimension of repo markets using novel euro area regulatory microdata. Our findings highlight the deep integration of funding markets across the Atlantic and the US dollar's outsized role. Our paper documents five key facts: (1) US dollar repos by euro area entities account for approximately 40% of total volumes and are comparable in size to euro repos; (2) term repos (with maturities beyond one day) are quantitatively more relevant than commonly thought, especially non-centrally cleared ones; (3) repo markets are predominantly collateral-driven, involving diverse nonbank financial players and trading motives; (4) banks' intragroup transactions form a large share of non-centrally cleared volumes; and (5) haircuts, even for riskier collateral, are often zero or negative, especially in euro trades. We show in two empirical applications that US monetary policy shocks spill over to euro repo rates and that negative haircuts arise from market power and collateral demand dynamics.

JEL Classification: G12, G14

Keywords: Repo market, US dollar funding, Haircuts, Bank intermediation

Non-technical summary

This paper analyzes the international dimension of repo markets using the Securities and Financing Transactions Datastore (SFTDS), an extensive dataset comprising detailed regulatory microdata from the euro area. The high granularity of SFTDS allows us to study repos in multiple currencies, most notably the US dollar. Our analysis provides a unique and comprehensive view of the international integration and dynamics of repo markets, particularly highlighting the critical role of the US dollar.

We present five novel empirical insights that significantly enhance the understanding of modern repo markets. First, US dollar repos involving euro area entities account for approximately 40% of outstanding USD and EUR repo activity, underscoring the significant international integration of the repo market and challenging the notion of market segmentation and home bias.

Second, term repos, or transactions with maturities longer than overnight, are quantitatively more important than commonly assumed. In particular, only 26% of euro-denominated and 50% of dollar-denominated non-centrally cleared transactions are overnight. Our analysis has significant implications for understanding funding stability and rollover risks.

Third, we find that repo markets are predominantly collateral-driven, reflecting the diverse participation and distinct trading motives of nonbank financial institutions. This trend is more pronounced in euro-denominated transactions, indicating structural differences across currencies.

Fourth, intragroup transactions within banking groups account for a substantial share of repo volumes. Specifically, they account for €700 billion in euro-denominated and €350 billion in dollar-denominated outstanding daily volumes. This finding highlights how banks internally manage liquidity and funding across international subsidiaries and underscores the importance of internal capital markets.

Fifth, we document the surprising prevalence of zero and even negative haircuts, where cash lenders provide more cash than the value of the pledged collateral. We find that such transactions are driven by the demand for specific collateral, market power, and the dynamics of internal capital markets, particularly pronounced in euro-denominated repos.

To further illustrate the implications of these findings, the paper conducts two focused

empirical applications. The first examines the international transmission of US monetary policy to repo rates in the euro area. We find a passthrough of US monetary policy to euro repo rates of approximately 5%. The second application explores the determinants of negative haircuts, providing empirical evidence for the patterns explored under fact 5, as well as notable differences between euro- and dollar-denominated markets.

Overall, this paper offers novel insights for policymakers and market participants regarding the structure and functioning of the international repo market, cross-border financial integration, and the mechanisms of monetary policy transmission and financial stability. It also offers new avenues for academic research on funding markets.

1. Introduction

The rise of international financial markets in the post-war era has been marked by the development of offshore dollar markets, most notably the Eurodollar market that emerged in the 1960s. This allowed non-US banks to take dollar deposits and make dollar loans outside the US, creating a parallel market for dollar borrowing and lending that played a crucial role in the internationalization of banking and finance.[1] Today's repo markets represent a modern evolution of these international funding dynamics, with secured lending replacing the unsecured interbank lending that characterized the early Eurodollar market. Like their Eurodollar predecessors, these markets demonstrate how dollar funding activities extend well beyond US borders and institutions.

We contribute to understanding these modern international funding markets by providing the first comprehensive study of multiple currency-denominated repo activity, with a focus on the US dollar and euro. To do so, we use novel microdata covering all repo transactions involving euro area entities. Importantly, our data also include transactions by branches or subsidiaries of entities headquartered outside the euro area, notably US banks' offices operating in the euro area. This results in a highly accurate snapshot of the structure and intermediation patterns in the international repo market and allows us to carefully investigate the anatomy of this market.

We delineate repo markets based on the currency denomination of transactions (in line with e.g., Committee on the Global Financial System, 2017). This currency-based definition is particularly relevant in the repo market: euro repo activity is not confined to the euro area, just as dollar repos are not confined to the US. A currency-focused approach avoids conflating currency with location and therefore provides a cleaner lens through which to examine the international dimension of repo markets.[2]

The angle we pursue in our paper is relevant for several reasons. First, even as the traditional Eurodollar market based on unsecured interbank lending has declined in importance, the US dollar (USD), as the world's primary reserve currency, continues to hold a particularly important position in global funding markets, as has been carefully documented in the ear-

[1] Schenk (1998) studies on the history of Eurodollar markets.

[2] Also see Avdjiev, McCauley, and Shin (2016) on this issue, who argue that international finance analysis needs to break free from the "triple coincidence" of treating the currency area, the decision-making unit, and the economic area as one and the same.

lier literature (see for example Ivashina, Scharfstein, and Stein, 2015; Maggiori, Neiman, and Schreger, 2020; Correa, Du, and Liao, 2022; Aldasoro, Ehlers, and Eren, 2022; Shin, 2023). Second, it is via these money markets that monetary policy exerts its most direct effects on financial markets. Repo markets are hence crucial for monetary policy transmission, and could be the source of spillovers both across currencies and markets. Finally, this market is key for banks' funding and liquidity management, and hence critical from a financial stability perspective. This is especially so when banks operate in a currency other than their home currency, notably the USD, giving rise to increased rollover risk.[3] Against this backdrop, a deeper understanding of the structure and dynamics in these markets is important for policymakers, market participants, and academia.

The key advantage of our study is the ability to draw on a highly granular dataset that provides a holistic perspective of repo markets. Our empirical results are based on the *Securities and Financing Transactions Datastore* (SFTDS). This novel dataset stems from the Securities and Financing Transactions Regulation (SFTR), which requires euro area entities to report all their securities financing transactions (SFTs). Due to the structure of the regulation, the dataset also includes the activity of these entities in currencies other than the euro, notably the US dollar. Such transactions occur, e.g., when euro area entities engage in foreign currency repos with each other or when they transact with foreign entities such as British or US banks.

Our paper is structured around five main stylized facts. They shed light on various aspects of the international dimension and deep integration of funding markets in the major currencies, and, in several instances, suggest a new perspective compared to prior findings that have been derived from narrower datasets.

First, we quantify the usage of the US dollar in money markets outside the US and the deep integration of euro area banks in the international dollar system. We show that dollar activity involving euro area entities is comparable in size to euro activity, with dollar-denominated transactions representing approximately 40% of total euro- and dollar-denominated outstanding volumes. This finding reflects the dominant role of the USD in global funding

[3]Foreign banks mostly lack direct access to Federal Reserve facilities, making their dollar funding potentially fragile during periods of market stress. As shown in studies of the Fed's international liquidity facilities (Bahaj and Reis, 2022; Goldberg and Ravazzolo, 2022), such fragility can amplify systemic risks. For example, if euro area banks face difficulties in obtaining dollar funding through repos, they can resort to fire sales of dollar assets, potentially creating broader market stress.

markets and qualifies earlier results such as Schaffner, Ranaldo, and Tsatsaronis (2019) who argue that repo markets are subject to home bias.

Second, we show that there is much more activity in repos with longer maturities, that is, going beyond overnight tenors, than commonly assumed.[4] The vast majority of prior work on repo has focused on short maturities (e.g. Mancini, Ranaldo, and Wrampelmeyer, 2016; Bechtel, Ranaldo, and Wrampelmeyer, 2023; Hüser, Lepore, and Veraart, 2024), giving rise to the idea that repo is almost exclusively overnight. One reason behind this focus in past work could be that overnight repos dominate datasets that cover transaction *flows*; another could be that overnight maturities are more closely linked to short-term interbank markets where central banks' monetary policy tends to exert its strongest control. Our data, in turn, allow us to examine *outstanding volumes*, which paints a more nuanced picture. For example, we show that longer-term repos account for a significant share of the market and that there is substantial variation in maturity structures between currencies. Specifically, only 26% of euro-denominated outstanding trades are overnight compared to 50% for dollar-denominated trades in non-centrally cleared transactions, suggesting fundamentally different uses of repo tenors across currencies. This compares to approximately 70% of centrally cleared outstanding transactions being overnight, regardless of the currency. These aspects related to the maturity structure are crucial for understanding funding stability and rollover risks in international repo markets, as longer-term commitments affect institutions' ability to adjust their funding structure during stress events.

Third, the structure of repo markets is predominantly collateral-driven rather than cash-driven, involving a diverse set of nonbank financial players and trading motives, with notable differences between currencies. The prevalence of collateral-driven transactions is stronger for euro than for US dollar repos: they represent 89% of euro-denominated versus 65% of dollar-denominated outstanding volumes. One factor could be the less homogeneous nature of euro collateral than USD collateral (Ehrmann and Fratzscher, 2017; Jiang, Lustig, Van Nieuwerburgh, and Xiaolan, 2020). Another could be that USD funding motives take a more central role for euro area entities, given the dollar's role as the world's primary funding currency, hence implying a greater role for general collateral baskets. Our findings also

[4]We define overnight repos as those with a maturity of one day. Thus, this also includes tomorrow-next and spot-next transactions.

show that collateral-driven trades dominate even for dollar repos.[5] However, even within collateral-driven transactions, we document substantial differences in the positioning of market participants. Whereas lower-tier (i.e non-dealer) banks and insurance corporations and pension funds (ICPFs) are the main net cash borrowers in the euro repo market, it is especially investment funds (mostly hedge funds) that are net cash borrowers in the dollar repo market as a source of leverage.

Fourth, we document a crucial role for internal capital markets, where banks shift funding between their subsidiaries or branches through internal repos. Intragroup transactions represent more than a third of euro-denominated and about a quarter of dollar-denominated outstanding volumes in non-centrally cleared repo.[6] While Cetorelli and Goldberg (2012b) highlight internal capital markets in traditional bank lending, we show their previously undocumented importance in repo markets. The significance of intragroup transactions regardless of currency shows how deeply integrated international repo markets are, blurring jurisdictional borders.

Fifth, haircuts (even for riskier collateral) are often zero, and even *negative* haircuts are quite common. Negative haircuts mean that market participants endowed with high-quality collateral can turn to the repo market to obtain more funding than the market value of the pledged security. We find that negative haircuts are particularly prevalent in euro-denominated trades, where they represent 9% of outstanding volumes compared to 4% in dollar-denominated trades. This negative haircut phenomenon suggests that the conventional view that haircuts primarily serve as a risk management tool for the cash lender (see Gorton and Metrick, 2010; Krishnamurthy, Nagel, and Orlov, 2014; Copeland, Martin, and Walker, 2014) may warrant reconsideration. Instead, our results suggest that negative haircuts arise from three main sources. First, since haircuts are endogenously set in bilateral transactions, they reflect market power, where certain institutions can negotiate better terms due to their stronger bargaining position. Second, negative haircuts indicate a high demand for specific securities. Receiving a particular type of collateral may be so valuable for certain players

[5] To put this into perspective, the earlier literature on the US repo market suggests that half of the core US market is collateral-driven (see D'Amico, Fan, and Kitsul, 2018; Baklanova, Caglio, Cipriani, and Copeland, 2019).

[6] For reference, Hardy, McGuire, and von Peter (2024) show that based on the locational banking statistics of the BIS, intragroup claims and liabilities represent between 13% and 37% of total claims and liabilities across their reporting countries.

that they accept that their cash lending is not fully covered by the collateral value. Third, negative haircuts are more prevalent in internal capital markets, where banking groups use negative haircuts to move funding between their members.

We include two empirical analyses, motivated by the five facts discussed above, to showcase the strength of our data and to provide additional analytical insights. First, connecting to the first fact on the prevalence of USD transactions involving euro area entities, we zoom in on international monetary policy spillovers to repo markets, leveraging the granularity of our data. We show that US monetary policy has significant spillover effects on euro repo rates and that the impact on dollar rates is heterogeneous by counterparty type. In particular, passthrough in USD rates is smaller when nonbanks are involved. However, even in the interbank market, passthrough deviates from a one-to-one relationship with the policy rate when smaller banks transact with larger banks. Second, we dissect the drivers of the negative haircut phenomenon discussed above and show how the importance of market power, collateral demand, and internal capital markets differs between euro and dollar repo markets. We find that the use of internal capital markets is especially important in explaining negative haircuts in euro-denominated transactions, whereas market power seems to be especially important in dollar-denominated transactions.

Together, these results provide new insight into the international dimension of repo. This applies both to the currency dimension – notably, the dollar as the main funding currency of the global financial system – and the geography dimension (cross-border activity involving entities from the euro area and non-euro area-resident counterparts). Several of the facts we document for repo activity along these international dimensions differ from those in previous research on single-currency repo markets or specific segments thereof. Our results thus suggest that some of the common views prevalent in the literature should be revisited. Consequently, our findings have important implications for understanding global money markets, intermediation patterns in the global financial system, monetary transmission, and financial stability.

The remainder of the paper is structured as follows. Section 2 provides an overview of the data employed and provides a taxonomy as well as basic descriptive statistics. Section 3 then presents the five facts of our paper in greater detail, while Section 4 presents the two empirical applications. Lastly, Section 5 concludes. A separate Appendix contains

information on data-cleaning procedures and provides additional results.

2. Data and Taxonomy

2.1. Data overview: the Securities and Financing Transactions Datastore

We make use of novel regulatory microdata, the *Securities and Financing Transactions Datastore* (SFTDS). It covers *all SFT activity* of euro area established entities and their branches. For that reason, our data cover not only the "euro" repo market (transactions denominated in euros) in a comprehensive way, but also a large share of the activity of the "foreign currency" repo market (transactions in US dollars and other currencies).

SFTDS results from the Securities and Financing Transactions Regulation (SFTR). SFTR is a comprehensive regulatory framework that mandates all entities established within the European Economic Area (EEA), branches of EEA-established entities located outside the EEA, and branches of non-EEA firms located inside the EEA to report their Securities Financing Transactions (SFTs). SFTDS represents the euro area subset of this.

The SFTDS repo market segment includes all repo and reverse repo transactions of entities established inside the euro area, branches of these entities located outside the euro area, and non-euro area entities located inside the euro area (see also Table B1 in the Appendix).[7] It is particularly the latter two features that are key to the international dimension of the data. On the one hand, subsidiaries and branches of non-euro area banks active in the euro area create a direct link between euro and foreign currency funding markets, for example, via their banking groups. On the other hand, branches of euro area banks active abroad capture activity purely outside of the euro area. For example, a repo transaction between the US branch of a euro area bank and a local US bank is included in our data.

In short, the data at our disposal provide a highly accurate and holistic snapshot of the *international* repo market covering repo transactions in different currencies by entities that have a locational euro area presence (of which some may also be of foreign, e.g. US and U.K., nationality). The two most common transactions are those denominated in euros (EUR) or US dollars (USD), which are the focus of this paper.

[7] SFTDS covers three types of SFTs, namely repo and buy/sell-backs, securities lending, and margin lending. In this paper, we focus on the first type, as it constitutes the largest segment of the data.

The main advantage of our data is its unprecedented comprehensiveness coupled with high granularity. Previous datasets on the repo market typically include only subsets of overall activity. For example, several insightful papers are based on the European Central Bank (ECB) Money Market Statistical Reporting (MMSR) dataset, which only covers transactions in euros reported by the largest banks (see for example Barbiero, Schepens, and Sigaux, 2024; de Souza and Hudepohl, 2024). Data obtained from private sector repo trading platforms such as Brokertec, MTS, or Eurex provide valuable information, but provide a rather specific view on particular segments (see for example Arrata, Nguyen, Rahmouni-Rousseau, and Vari, 2020; Ballensiefen, Ranaldo, and Winterberg, 2023). By contrast, the quantitatively very large – but very opaque – non-centrally cleared, or 'bilateral', repo segment has (with very few exceptions) been largely unexplored, primarily due to a lack of data. Similarly, data on the US repo market are limited by the reporting of a subset of entities or by the type of clearing (see for example, Copeland, Martin, and Walker, 2014; Krishnamurthy, Nagel, and Orlov, 2014; Hempel, Kahn, Mann, and Paddrik, 2023), highlighting the benefits of a more comprehensive dataset, such as the SFTDS used in this article.

2.2. Taxonomy

It is useful first to provide clarity on key market categorizations and terminology. To this end, we propose a taxonomy in Figure 1. The guiding principles of the categorization follow the key decision-making processes of market participants while showing what information is included in the SFTDS. This classification consists of *three hierarchical levels* that capture the choices that market participants make when participating in a repo transaction. The taxonomy in Figure 1 provides a framework and also shows the observed outstanding repo volumes across different types of transactions to provide basic information about different types of repo transactions.

At the *highest level of decision-making*, the main determinant of a repo transaction is the underlying economic motive. Market participants enter into repos with a desire to either source a specific security as collateral or to lend against a specific asset they hold (commonly referred to as collateral-driven transactions). Alternatively, they may want to raise cash or lend against collateral, but without making reference to a specific set of collateral (commonly referred to as cash-driven transactions).

The relative quantitative importance of these motives in terms of volumes differs strongly in SFTDS. We follow the general assumptions in the literature that trades with general collateral underlying are cash-driven (or funding-driven), whereas trades with specific collateral underlying are collateral driven (see for example Mancini, Ranaldo, and Wrampelmeyer, 2016; Brand, Ferrante, and Hubert de Fraisse, 2019; Schaffner, Ranaldo, and Tsatsaronis, 2019).[8] Approximately €3.7 trillion (or >75%) in daily outstanding euro- and dollar-denominated volumes reflect collateral-driven transactions compared to approximately €1 trillion (or <25%) for cash-driven transactions. Obviously, this fundamental motive for cash versus collateral is linked to a choice regarding the currency denomination. If an entity wants to source euro collateral, they will have to lend euro cash, while they would lend dollar cash for dollar collateral.[9] If they want to source cash, the link is even more direct.

Market participants must then decide on the appropriate clearing mechanism. The *second level* of our taxonomy thus distinguishes between (i) centrally cleared, (ii) triparty, and (iii) non-centrally cleared repo transactions.[10]

Approximately 41% of outstanding euro transactions are centrally cleared compared to 4% of outstanding dollar transactions. Moreover, Figure 1 shows that this is largely concentrated in transactions with specific collateral. This is because European central clearing counterparties (CCPs) only clear euro-denominated transactions and usually ask for government securities to be pledged. In order for dollar-denominated centrally cleared transactions to be present in SFTDS, the euro area entity must be a member of the Fixed Income Clearing Corporation (FICC) in the US, which is only the case for a handful of euro area entities. As a result, the volume of centrally cleared USD repos in our dataset remains relatively small.

Triparty repo represents another distinct clearing mechanism. Unlike a centrally cleared repo, which primarily involves specific collateral transactions, a triparty repo is typically

[8]While this delineation is not perfect, we also check in Table **??** the share of transactions with specific collateral that is trading below the general collateral rate or deposit facility rate. We find that the majority of transactions with specific collateral also have repo rates below these benchmark rates.

[9]It is in principle also possible to engage in a repo where the loan currency differs from the collateral currency. However, this market segment, commonly referred to as cross-currency repo (see Kohler, Müller, et al., 2019), is insignificant in terms of volumes.

[10]We categorize clearing categories as "centrally cleared" if a CCP clears a transaction, "triparty" if a triparty-agent is involved, and "non-centrally cleared" otherwise. Clearing structures in the US are more complex than these three categories, as shown by Copeland and Kahn (2024). However, since FICC DVP and GCF repo, as well as sponsored repos, are a small part of our data due to the limited membership of euro area entities at the FICC, we combine these segments into "centrally cleared" transactions.

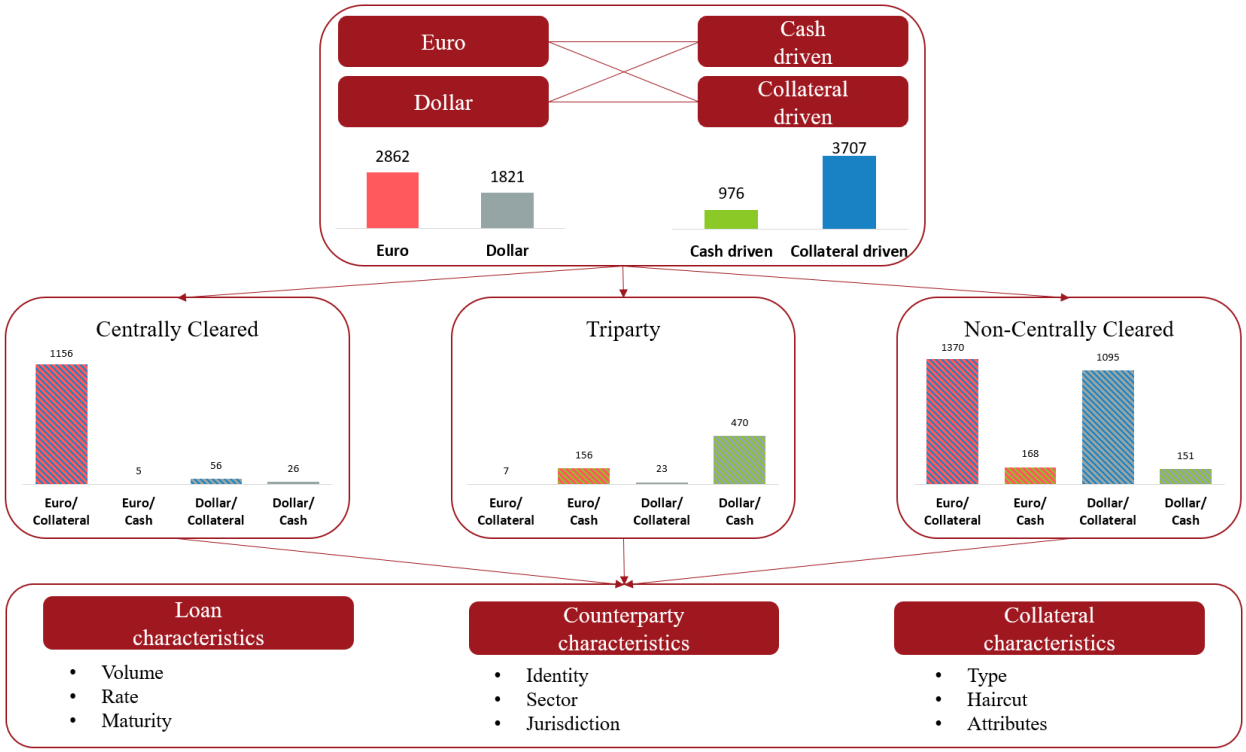
associated with cash-driven activity. Entities in the Euro area are important players, especially in the USD triparty segment, as can be seen in Figure 1. It is through the USD triparty market that euro area banks obtain dollar funding, primarily from money market funds (Chernenko and Sunderam, 2014; Eren, Schrimpf, and Sushko, 2020; Aldasoro, Ehlers, and Eren, 2022).

Finally, non-centrally cleared – or 'bilateral' – transactions represent the quantitatively most important segment. In this category, repos are settled directly between counterparties without the intermediation of a CCP or a triparty agent. Given the structural differences between the clearing mechanisms in the two currency areas, non-centrally cleared transactions provide the most suitable basis for a direct comparison between the euro and dollar repo markets. In fact, the segments in this category are much more similar in size. Collateral-driven euro transactions represent approximately €1.4 trillion in outstanding volumes on average, compared to approximately €1.1 trillion for dollar transactions. Cash-driven transactions represent €168 billion in outstanding volume for euro transactions vs. €151 billion for dollar transactions.

The *third level* in our taxonomy concerns the specific characteristics of the transaction. Such level of detail is only feasible given the granularity of the SFTDS data collection. This includes the loan characteristics of the repo agreement, such as the repo rate, maturity, and volume, as well as the attributes of the counterparties (e.g., their legal identities, sectors, jurisdictions) and the collateral (e.g., type, haircut, maturity).

By distinguishing repo market activity along these three hierarchical levels – transaction motive and currency choice, clearing mechanism, and transaction characteristics – this taxonomy serves as a key point of reference on how we structure the subsequent empirical analysis.

Figure 1: The repo market through the lens of SFTDS



Note: Numbers are in billion euros and based on daily outstanding volumes. Sample period: 2021-01-01 – 2024-04-01

2.3. Descriptive statistics

Table I provides an overview of key characteristics of the repo market in our sample.[11] There are on average 39,538 new trades per day, resulting in total daily new volumes of €1,280 billion. The average trade size is fairly large, at €32.24 million, due to the presence of some very large transactions. The median trade size, in turn, is markedly lower, at €7.51 million.

Next, we disaggregate repos by their currency of denomination, which allows us to compare these results to the existing literature. Euro-denominated transactions involving 567 unique entities represent the largest segment with 26,870 new trades per day, or 22,111,598 in total.[12]

[11] Given the size and granularity of the data, they need extensive cleaning, preparation, and filtering. We provide details on these steps in the Appendix **??**.

[12] For context, Mancini, Ranaldo, and Wrampelmeyer (2016) analyze 109,473 transactions in total from 2006 to 2013, focusing on general collateral transactions through Eurex. Other studies that use MMSR, such as Greppmair and Jank (2023), rely on data from 70 reporting banks. This, of course, also includes the counterparties of these banks, which increases the total number of entities involved; however, it still limits the data compared to the comprehensive reporting under SFTR.

The next largest currency after the euro is the US dollar. On average, there are 10,180 USD trades per day (or 7,624,575 in total), with €1.81 trillion in outstanding volume per day. Our data comprise 943 entities that are involved in new dollar-denominated transactions. For comparison, Krishnamurthy, Nagel, and Orlov (2014) who analyze 16,000 transactions in total from 2007 to 2010, or Hempel, Kahn, Mann, and Paddrik (2023) and Baklanova, Caglio, Cipriani, and Copeland (2019) who examine nine dealers with $900 billion outstanding per day in non-cleared bilateral repo, which is arguably most comparable to our data.

The role of the US dollar is underscored by the fact that daily new USD volumes are almost equivalent on average to EUR volumes (€553.33 billion compared to €653.74 billion) according to Table I. Moreover, according to the BIS Triennial Survey, the daily turnover of FX swaps for the EUR-USD pair totaled approximately $1 trillion in 2022, roughly matching the combined daily volume of new euro- and dollar-denominated repos reported in the SFTDS. This fact shows that it is imperative to study the dollar usage of non-US entities to understand the functioning of modern repo markets. On the other hand, British Pound repos and repos in other currencies are clearly less relevant. In the remainder of the paper, we will therefore focus on euro- and dollar-denominated transactions in our analysis.

Regarding clearing arrangements, centrally cleared transactions account for 19,007 trades per day, while non-centrally cleared and triparty transactions account for 18,719 and 1,812 new trades per day, respectively. In terms of volumes, approximately 38% of daily new volumes are centrally cleared across all currencies in SFTDS.

The maturity structure shows significant activity beyond overnight trades: On average, 35,163 daily new transactions are overnight and 4,375 have longer maturities (so-called term repos). The relevance of this becomes evident when examining outstanding balances instead of new transaction flows. €5.40 trillion are outstanding per day on average in SFTDS, which is more than four times the daily trading volume. This difference comes from the accumulation of transactions with longer maturities that remain in the data on outstanding transactions until they reach maturity.

Breaking repo activity down by collateral type reveals that government securities dominate repo trading. They account for 29,222 new trades on average per day with notably larger average and median trade sizes of €34.17 million and €11.25 million, respectively, compared to a mean and median of €27.08 million and €1.54 million for non-government

collateral. Approximately 78% of daily new volumes have government securities underlying as collateral.

Table I: Summary statistics of repo activity

	Number of trades (per day)	Average trade size (mln)	Median trade size (mln)	Volume (bn)	Outstanding Volume (bn)	Number of entities
Overall	39,538	32.24	7.51	1280.12	5,400.25	1,411
Currency						
EUR	26,870	24.52	7.60	653.74	2,854.68	567
USD	10,180	54.44	4.18	553.33	1,804.99	943
GBP	2,674	38.34	12.60	97.98	445.25	181
Other	719	33.60	11.88	24.21	455.63	121
Clearing						
cleared	19,007	25.85	11.59	486.87	1,329.93	165
non-cleared	18,719	32.60	3.76	613.04	3,416.79	1,017
triparty	1,812	103.79	0.48	180.22	653.53	458
Maturity						
overnight	35,163	31.89	7.69	1127.20	2,043.57	1,103
non-overnight	4,375	35.19	7.41	152.92	3,356.68	525
Collateral						
GOVS	29,222	34.17	11.25	995.47	4,016.02	978
non-GOVS	10,317	27.08	1.54	284.65	1,384.23	738

Note: The data presented in this table is based on daily activity. GOVS = Government securities. The reason that the number of trades for the individual currencies does not sum to the overall amount is that not all currencies have data on all dates (e.g., due to regional holidays), which skews the averages. Sample period: 2021-01-01 – 2024-04-01

3. The international dimension of repo: five facts

Our empirical analysis exploits the international dimension of our data and allows us to draw novel insights about the functioning of global repo markets in general and the role and global reach of the US dollar in short-term funding markets in particular. We structure our results around five key stylized facts.

Using our granular data, we first quantify the substantial size of dollar activity relative to euro activity. Second, we go beyond the commonly studied overnight segment and examine the maturity structure of repo markets. Third, we analyze the differences between funding- and collateral-driven transactions and document substantial differences between dollar and euro transactions. Fourth, we document the important role of internal capital markets con-

ducted via intragroup repo transactions. Fifth, we document a strikingly large share of transactions with negative haircuts.

3.1. European banks are deeply embedded in US dollar funding markets

We start by quantifying the share of US dollar-denominated activity in our data. Since most of the earlier literature has focused on repo in a single currency, a little understood segment is repo activity that transcends the currency and jurisdictional boundaries.[13] We find that this segment is economically large. Specifically, dollar-denominated transactions represent approximately 40% of combined euro- and dollar-denominated outstanding volumes in our data, averaging €1.8 trillion compared to €2.8 trillion for euro-denominated transactions. [14]

The substantial heft of dollar repos in a dataset that is based on euro area entity reporting seems striking in itself, especially since the euro is already a large currency bloc. Figure 2 further breaks down dollar-denominated outstanding transactions by counterparty jurisdiction. We show that 'offshore dollar' transactions – where both counterparties to the transaction do not feature any US dimension, neither in terms of residence nor in terms of nationality – represent approximately 34% of all dollar-denominated outstanding transactions.[15]

This large dollar usage outside of the jurisdictional confines of the US is reminiscent of the Eurodollar market. A key feature of this market used to be its underpinning by large institutional USD deposits that are not liabilities of any US-based entities, which in turn have been used to fund dollar assets.[16] Given the demise of deposit markets and the discontinuation of LIBOR, our findings indicate that the Eurodollar market is still going strong, but has morphed into a market largely underpinned by repo as opposed to unsecured interbank deposits. To the best of our knowledge, so far, the literature has neglected investigating the reach of the dollar in international repo markets and providing an anatomy of this modern

[13] The data used by Correa, Du, and Liao (2022) does include repos in foreign currency. However, their data are based on balance sheets, which is why the transaction-level nature of our data provides additional insights. Furthermore, Klaus and Mingarelli (2024) provide insight into the characteristics of USD repos in the euro area. However, they focus solely on the perspective of euro area banks.

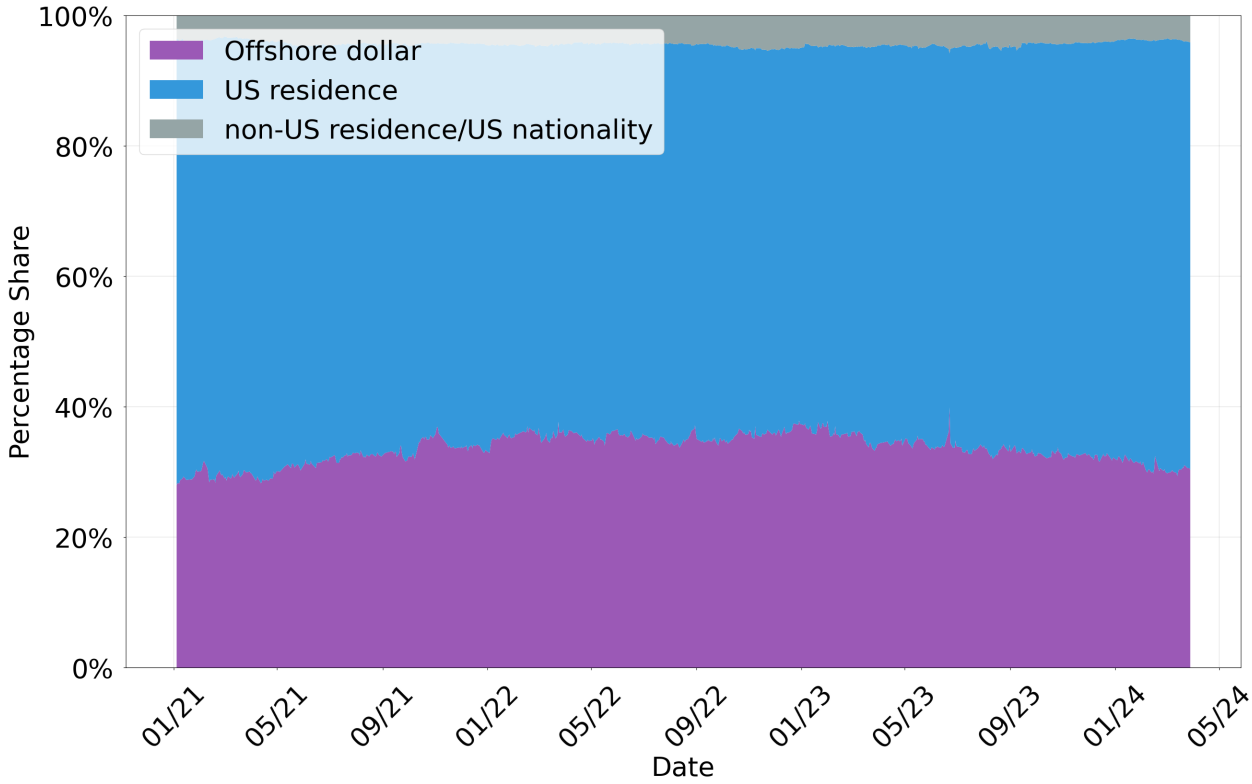
[14] Figure D3 in the Appendix summarizes these results, showing the amount of outstanding volumes.

[15] We show some evidence for segmentation within dollar-denominated transactions in Table D3 by showing that repo rates can differ between the segments of Figure 2.

[16] The Eurodollar market emerged in the mid-20th century as a system of offshore dollar deposits and lending outside U.S. regulatory reach. Eurodollars were created through interbank transactions, with non-U.S. entities lending and borrowing dollars without direct Fed oversight. For a fundamental overview, see Schenk (1998) on the Eurodollar market's origins or Frydl (1998) on its relationship with monetary policy in the past.

counterpart to eurodollar markets.

Figure 2: Daily outstanding dollar volumes by counterparty jurisdiction

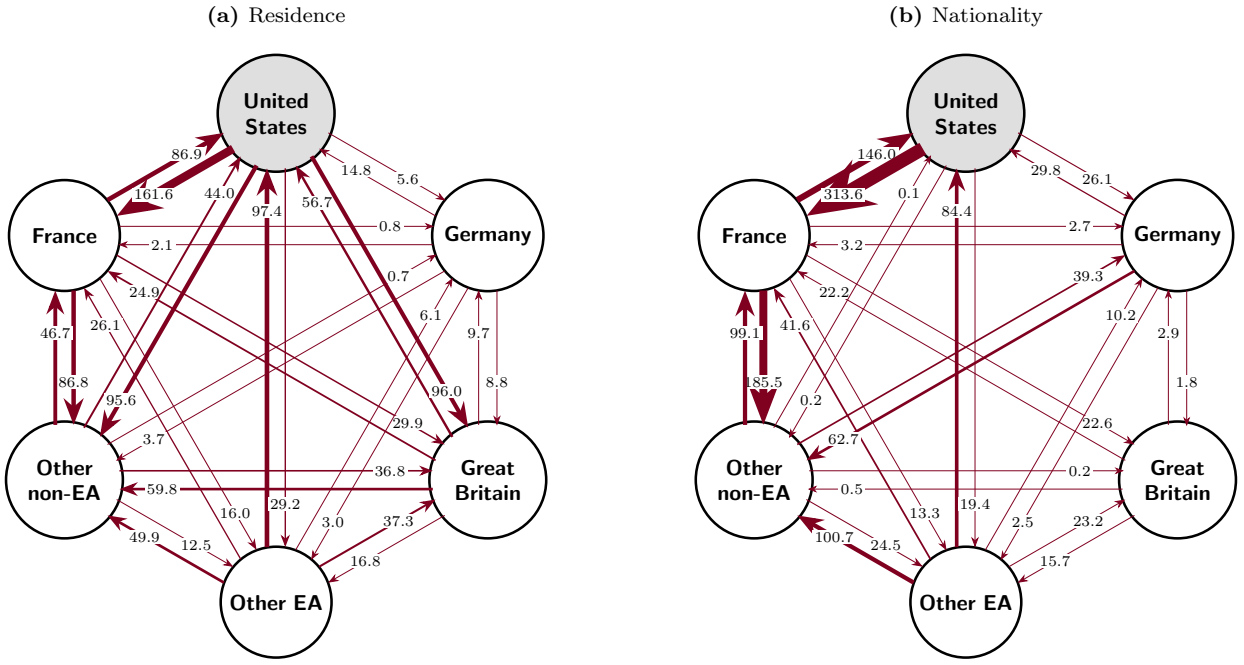


Note: This figure shows outstanding dollar volumes broken down by the counterparty jurisdiction. 'Offshore dollar' refers to the case in which neither counterparty is a US resident or a US national. 'US residence' refers to the case in which at least one of the counterparties is a US resident. 'non-US residence/US nationality' refers to the case in which none of the counterparties are US residents, but at least one of them is a US national. Sample period: 2021-01-01 – 2024-04-01

Additionally, Figure 3 shows the flow of outstanding transactions while distinguishing between the residence and nationality view according to McGuire, von Peter, and Zhu (2024). Comparing these two perspectives, we observe that the connection between France and the United States is especially much more pronounced in the nationality view. This indicates that US subsidiaries are active in the repo market outside of the US jurisdiction, further highlighting the deep integration of the international repo market.

We now zoom in more closely on the segment of bilateral (non-centrally cleared) transactions. This segment provides a clearer benchmark for assessing relative currency importance, as euro area central clearing counterparties (CCPs) do not clear foreign currency-denominated trades. Moreover, participation in the Fixed Income Clearing Corporation (FICC)—the key clearing venue for US dollar repo transactions—requires membership, which is only accessible

Figure 3: USD Outstanding cross-border flows



Note: This figure shows the flow of cash in dollar-denominated outstanding transactions. Thus, the arrows are pointing from the cash-lender to the cash-borrower. The numbers are based on daily averages in outstanding data and are in billion euros. We distinguish by residence and nationality in line with McGuire, von Peter, and Zhu (2024). Sample period: 2021-01-01 – 2024-04-01.

to a limited number of European players. As a result, most foreign currency repos in our dataset remain non-centrally cleared. Within this segment, dollar-denominated transactions account for approximately 45% of total non-centrally cleared outstanding volumes (compared to 55% for euro-denominated transactions), based on gross positions reported in Table II.

Table II further reveals substantial differences in the jurisdictional composition of euro- and dollar-denominated transactions. The data are broken down by entity residence and nationality in three jurisdictions: the euro area (EA), the United States (US), and the rest of the world (ROW). From a residence perspective, non-euro area entities account for approximately a third of euro gross positions (summing all US and ROW EUR gross positions results in €1,065 billion out of €3,079 billion in total). They especially dominate dollar activity with nearly 70% of gross positions (€1,584 billion out of €2,290 billion). A nationality perspective, though, reveals that the activity of US nationals in euro-denominated transactions is much stronger than the residence view would suggest. This shows that US entities are operating in the euro repo market via their branches or subsidiaries.[17]

[17]In fact, we see many US entities are located in the ROW when engaging in euro-denominated transactions

Beyond gross positions, the table also highlights notable differences in net positions (cash borrowing minus cash lending). Relative to the size of the gross positions, euro area residents are relatively balanced in both euro- and dollar-denominated transactions, though with tendencies to borrow euros and lend dollars. US residents engage relatively little in euro-denominated transactions but are clearly net lenders of dollars. Conversely, entities that are neither residents of the US nor of the euro area overall tend to be net dollar borrowers. These patterns deviate only slightly when considering the nationality perspective.

Our findings highlight that it is not just US entities that are providing US dollars, but also euro area entities. This is in line with the view of euro area banks acting as global intermediaries, accounting for a large share of dollar-denominated lending, as shown for example by Ivashina, Scharfstein, and Stein (2015) or Aldasoro, Ehlers, and Eren (2022).

Table II: Non-centrally cleared outstanding borrowing and lending positions by currency and jurisdiction

	Residence			Nationality		
	EA	US	ROW	EA	US	ROW
Borrowing						
EUR	1040.11	11.29	488.21	1043.31	167.25	329.04
USD	330.83	348.21	466.15	417.91	279.93	447.35
Lending						
EUR	973.41	9.29	556.20	926.68	194.94	417.29
USD	375.11	481.43	288.66	491.78	360.14	293.29
Gross positions (cash borrowing plus cash lending)						
EUR	2013.52	20.58	1044.41	1969.99	362.19	746.33
USD	705.94	829.64	754.82	909.69	640.07	362.19
Net positions (cash borrowing minus cash lending)						
EUR	66.70	2.00	-68.00	116.63	-27.68	-88.24
USD	-44.28	-133.23	177.49	-73.87	-80.21	154.06

Note: This table reports average daily outstanding volumes in billion euros disaggregated by residence or nationality. In both cases, we report data for the euro area (EA), the United States (US), and the rest of the world (ROW) entities. We only consider non-centrally cleared transactions. Gross positions refer to the sum of cash borrowing and lending activity, whereas net positions refer to cash borrowing minus cash lending positions. Sample period: 2021-01-01 – 2024-04-01

Our findings suggest that two common views in the literature need to be at a minimum amended, if not overturned.

because the increase in EUR activity when comparing US residence to US nationality, matches closely the decrease in EUR activity when comparing ROW residence to ROW nationality.

First, our findings qualify the notion expressed in the earlier literature that repo markets are geographically segmented and exhibit home bias (Schaffner, Ranaldo, and Tsatsaronis, 2019). True, the euro repo market likely exhibits some degree of home bias within its member states (as visible if a particular market subset, like the centrally cleared market, is studied). However, the substantial dollar presence involving EA residents, especially in bilateral repos, suggests a deep integration of euro area entities in global short-term funding markets.

Second, the patterns we document reveal important details on the scale of European institutions' role in dollar intermediation, with substantial activity both on the funding but also on the lending side. This complements the work by Du and Huber (2024) who show that foreign investors have expanded their dollar security holdings six-fold over the past two decades, Aldasoro, Ehlers, and Eren (2022) who document that US money market funds are a key source of dollar funding for non-US banks via unsecured and secured wholesale funding markets, and Aldasoro, Eren, and Huang (2021) who show that nonbanks are becoming increasingly important for the dollar-sourcing of non-US banks. We add to this by showing a comprehensive account of the scale of euro area entity dollar activity via the repo market, highlighting that repo transactions serve as a key mechanism for short-term dollar liquidity management of euro area entities.[18] This reliance on repo markets for dollar liquidity underscores that the liquidity of US Treasuries is not simply a natural market feature, but one underpinned by institutional arrangements and the intermediation capacity of repo markets (Menand and Younger, 2023).

Overall, our results provide a new perspective on the international integration of repo markets by showing that dollar repo activity involving euro area entities is both quantitatively significant and, in many cases, entirely detached from direct involvement of US entities. Moreover, the presence of US and other non-EA entities in euro-denominated repo through subsidiaries and branches further underscores the blurring of geographical boundaries in secured funding markets, adding an additional dimension to the notion of home bias and refining our understanding of how global entities engage in global funding markets.

Our findings on the heft of the dollar in international repo activity have important implications for both research and policy. For researchers, it demonstrates that studying repo markets through a single-currency lens may miss a substantial part of the overall activity of

[18] see also Du, Strasser, and Verdelhan (2025) for how European banks aronud regulatory reporting dates substitute on-balance sheet repo funding and switch to off-balance sheet FX swaps.

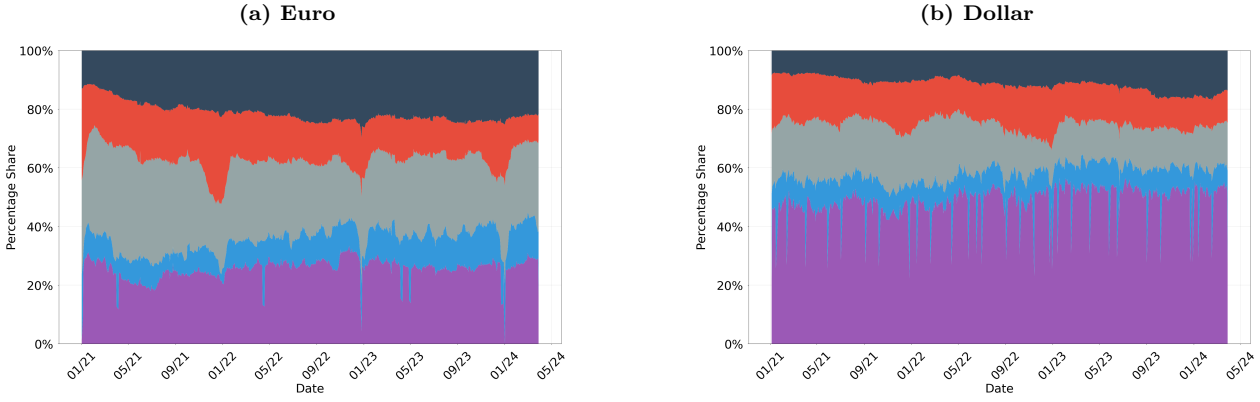
certain counterparties, potentially leading to incomplete conclusions about market structure and dynamics. For policymakers, particularly central banks, this suggests that monitoring frameworks should explicitly account for foreign currency repo exposures. Moreover, substantial dollar activity in international repo markets also highlights the importance of central bank swap lines, as disruptions in dollar funding markets can significantly impact non-US financial institutions (e.g., Bahaj and Reis, 2022).

3.2. Longer-term repos play a much bigger role than commonly assumed

We now explore the maturity structure of repo. The recent empirical literature, typically using flow data, focuses heavily on the overnight segment that dominates flows. However, looking at outstanding volumes paints a somewhat different picture of the relative importance of different tenor segments and implies that more research is needed to understand this part of the market.

In fact, in Figure 4 we show that trades with different tenors exhibit substantial variation between currencies. For example, in non-centrally cleared transactions, only 26% of euro-denominated and 50% of dollar-denominated transactions are overnights, while approximately 70% of centrally cleared transactions are overnights (regardless of the currency).

Figure 4: The maturity distribution of outstanding transactions depending on currency in non-centrally cleared transactions



Note: The graphs show the share of each maturity bucket based on outstanding volumes. This considers only fixed repo transactions, as open repos do not have a maturity date. The buckets are overnights, up to one week, one week - one month, one month - three months, and more than three months. Sample period: 2021-01-01 – 2024-01-01

Thus, it seems that euro-denominated transactions tend to be longer-term than dollar-

denominated transactions. However, Table III reveals a more nuanced relationship between currency and transaction maturity, which depends strongly on the underlying structural characteristics of the repo market. The coefficient on the USD dummy variable is positive and highly significant in the baseline specification, indicating that dollar transactions have, on average, a two-day longer maturity than euro transactions. This contrasts with what we observe in Figure 4. Once structural controls are included, however, the effect changes. When sector controls are added (with dealer banks as the baseline category), the coefficient becomes insignificant. This suggests that dollar-denominated transactions involving non-dealer banks must be longer-term than euro-denominated transactions, which explains the positive coefficient in the first specification. Moreover, specification (5) shows that, when controlling for clearing type (with bilateral transactions as the baseline), dollar-denominated maturities tend to be shorter, although insignificantly so. Combining the clearing and counterparty dimension, specification (7) shows that it is the combination of bilateral transactions and dealer bank cash borrowing that leads to euro-denominated transactions being longer term. This suggests that counterparties and the clearing type are driving the aggregate pattern in Figure 4. This could reflect European banks using dollar repos for liquidity management—requiring flexibility through short maturities—whereas non-banks may use dollar repos for more strategic purposes, such as trading in the case of hedge funds.

Thus, the non-centrally cleared segment, which represents approximately 60% of outstanding volumes in both euro and dollar repo markets, exhibits the most variation in maturities, while the type of counterparty also plays a key role. To better understand this variation, we now analyze the sectors that drive the observed differences in maturity structures in more detail.

Figure 5 presents the distribution of net outstanding positions between maturity buckets for transactions in euros and dollars. Positive values indicate net cash borrowing (collateral lending) positions, while negative values correspond to net cash-lending (collateral borrowing) positions.

A key observation is that, on the one hand, dealers in euro-denominated transactions maintain relatively small net positions in the overnight segment, whereas in dollar-denominated transactions, they are substantial net borrowers. This asymmetry underscores the role of the

Table III: Estimated Effect on Maturity by Currency

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
USD	2.10***	0.93	-0.04	2.12**	-0.97	-1.83	-2.72**	2.90***	-3.20**
	(0.81)	(1.08)	(0.72)	(0.85)	(1.59)	(1.52)	(1.17)	(0.87)	(1.34)
Controls									
Volume	Y	Y	Y	Y	Y	Y	Y	Y	Y
Lend sector (*dealer*)		Y				Y			Y
Borr sector (*dealer*)			Y				Y		Y
Intragroup				Y					Y
Clearing (*bilateral*)					Y	Y	Y		Y
Collateral (*govs*)								Y	Y
Date FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Constant	3.26***	2.81***	2.26***	3.90***	7.11***	6.72***	5.33***	2.20***	1.48*
	(0.32)	(0.24)	(0.28)	(0.33)	(1.70)	(1.73)	(1.32)	(0.26)	(0.85)
Obs.	30,402,873	30,402,873	30,402,873	30,402,873	30,402,873	30,402,873	30,402,873	29,657,848	29,657,848
R^2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: The underlying regression is $\text{Maturity}_{it} = \alpha + \beta \cdot USD_{it} + \boldsymbol{\delta}'\mathbf{X}_{it} + \mu_t + \varepsilon_{it}$, where USD_{it} is a dummy variable equal to one if transaction i on date t is denominated in dollars. Baseline categories: lender sector = dealer; borrower sector = dealer; clearing = bilateral; collateral = government securities. Standard errors are clustered by counterparty-pair and reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Sample: 2021-01-01 – 2024-04-01.

US dollar as a critical funding currency for market-making activities.[19] On the other hand, dealers are net lenders (collateral borrowers) in longer-term transactions both in euro- and dollar-denomination. This could relate to inventory management motives of dealers as explored in Cohen, Kargar, Lester, and Weill (2024), who build a model in which dealers can only intermediate assets that they hold in inventory. Thereby, long-term repos could be used by dealers to maintain such inventories. In addition, investment funds (which are largely composed of hedge funds in our data) show almost opposite net positions between currencies. In euro-denominated transactions, they are net cash lenders (collateral borrowers), while in dollar-denominated transactions, they are net cash borrowers (collateral lenders). Their sourcing of leverage via US dollar repos squares well with these players being active in the cash-futures basis trade (Schrimpf, Shin, and Sushko, 2020; Barth, Kahn, et al., 2021; Kruttli, Monin, Petrasek, and Watugala, 2021; Barone, Chaboud, Copeland, Kavoussi, Keane, and Searls, 2023). Pinter (2023) does a similar analysis for the gilt repo market and finds similar patterns across sectors as in our euro-denominated transactions. This suggests that hedge funds' liquidity and funding strategies differ significantly depending on the currency

[19] In Appendix Table E5 we explore the degree of maturity transformation done by dealer banks.

denomination.

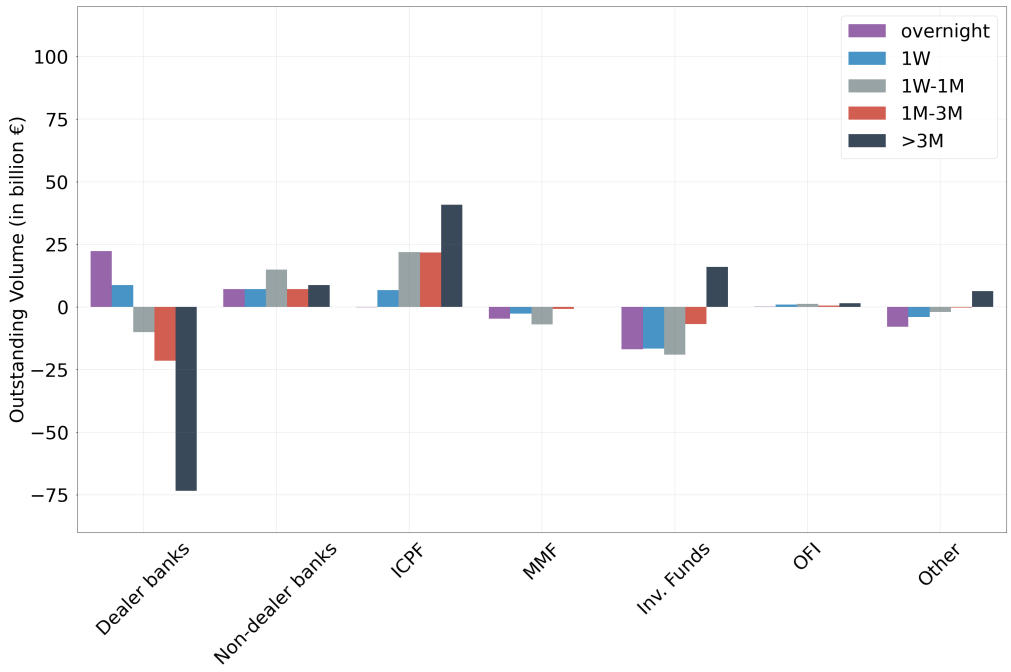
These insights highlight that maturity structures in non-centrally cleared transactions are shaped not only by market conventions but also by the distinct funding and investment needs of different financial entities across currencies. The ecosystem here not only includes banks, but also increasingly so, various types of nonbank financial institutions (NBFIs) such as hedge funds and liability-driven investors (insurers and pension funds). The divergence in net positions between euro and dollar transactions further emphasizes the importance of analyzing repo markets through a multi-currency lens.

These findings significantly extend previous results, especially in the literature on the euro area, which has mainly focused on overnight transactions (see for example Arrata, Nguyen, Rahmouni-Rousseau, and Vari, 2020; Corradin and Maddaloni, 2020; Ballensiefen, Ranaldo, and Winterberg, 2023). The common approach of focusing only on this segment stems from the fact that, for many research questions, working with data on *trading flows* is most appropriate. In a flow dataset, every transaction is only recorded once, that is, at the time the transaction takes place, making it especially useful when studying subjects such as the reaction of repo rates to central bank policies. From this perspective, overnights indeed account for the majority of transactions. However, for many research questions, particularly those related to financial stability and balance sheet management, it is more appropriate to study data on *outstanding positions*, where every transaction remains in the data until the contract maturity. In such a dataset, transactions with longer maturities can accumulate to large positions over time and are not masked by the high number of ultra short-term trades dominating flow datasets. Looking at outstanding positions thus more accurately reflects the actual risk exposures and funding structures of key entities.

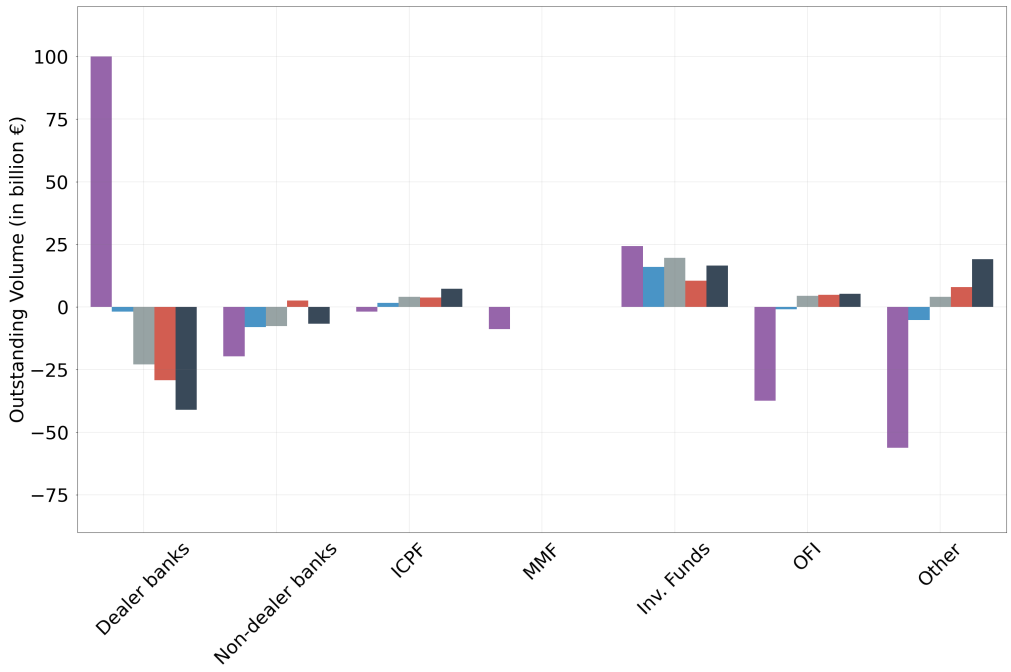
Our results relate to the literature on USD repo markets, where data is scarce. Baklanova, Caglio, Cipriani, and Copeland (2019) use data from nine bank holding companies on three dates, showing maturity buckets based on bilateral transactions dominated by Treasury securities. Their findings on repo tenor align with our results for dollar-denominated/non-centrally cleared transactions, with about half of the activity being overnight. Hempel, Kahn, Mann, and Paddrik (2023) use data from nine dealers on three dates, considering centrally-cleared and triparty transactions. They find 15% of centrally cleared transactions and 35% of triparty transactions have maturities over one month, compared to 10% and 27% in our

Figure 5: Outstanding net positions based on sector and residual maturity

(a) Euro



(b) Dollar



Note: The graphs show the net positions of different sectors in different maturity buckets. This considers only fixed repo transactions and non-centrally cleared transactions. The buckets are overnights, up to one week, one week - one month, one month - three months, and more than three months. Net positions are defined as cash borrowing − cash lending. We define dealers as those banks that hold a primary dealer license as published by the European Securities and Markets Authority (ESMA). ICPF = Insurance Corporations and Pension Funds; MMF = Money Market Fund; OFI = 'Other Financial Intermediary'. Sample period: 2021-01-01 – 2024-01-01

data, respectively. While some of our results align with these estimates, we extend them by providing a detailed account of repo maturity structure over time and across sectors and currencies.

These insights on the prevalence of longer-term repos have important implications. They matter particularly for aspects such as the assessment of banks' dollar funding risks, where the cost and availability of rolling over longer-term contracts during stress periods could pose difficulties. Additionally, from a policy perspective, understanding the full maturity structure is crucial for designing effective monitoring frameworks that are able to detect risks such as build-ups of funding concentration.

3.3. Repo is predominantly collateral-driven, with NBFIs as an integral part of the ecosystem

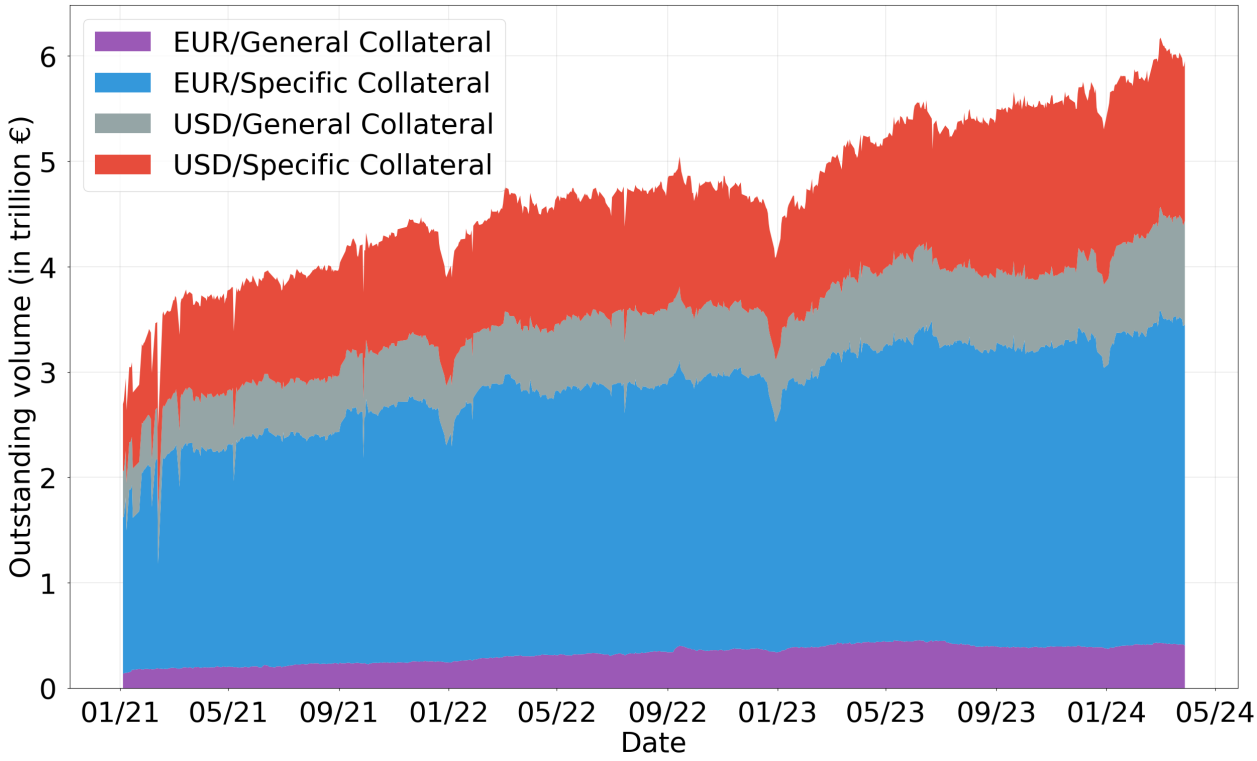
We next turn to the motives of repo transactions in different currencies and their implications for market structure. Transactions can be predominantly funding-driven, i.e. a counterparty is primarily focused on sourcing or placing cash, or collateral-driven, i.e. a counterparty seeks to pledge or get hold of a specific security. This difference is crucial to understanding the economic functioning of the repo market. We show that USD and EUR repo transactions are different in this respect.

We continue to work under the conventional assumption that trades with a general collateral basket underlying are funding-driven (cash-driven). Trades with specific collateral, in turn, are collateral-driven.

Based on this delineation, Figure 6 shows a breakdown of outstanding cash-driven and collateral-driven volumes in EUR and USD. In absolute terms, collateral-driven transactions dominate for both currencies, that is, they represent almost 90% of euro-denominated outstanding volumes and 65% for dollar-denominated transactions. In relative terms, the market for euro repos is thus significantly more collateral-driven than the market for USD repos. One factor here could be the less homogeneous nature of euro collateral than USD collateral.[20] Another could be that USD funding motives take a more central role for euro area entities, given the dollar's role as the world's primary funding currency.

[20]For example, entities in the euro area might be worried about wrong-way risk, meaning cash-lenders would want to make sure that they lend against sovereign debt that is different from the jurisdiction of the cash borrower.

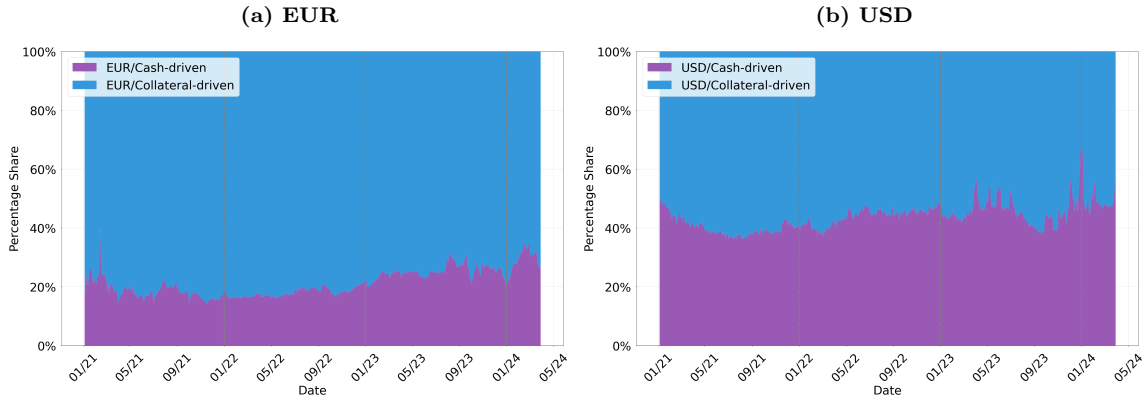
Figure 6: Daily outstanding volumes by collateral type and currency



Note: This chart shows outstanding volumes broken down by the type of collateral (general or specific) and currency. Sample period: 2021-01-01 – 2024-04-01

Specific collateral indicates that the collateral taker has requested a specific security, therefore there must exist some need for that specific collateral. However, we can conduct robustness by further breaking down transactions with specific collateral using the repo rate. As explained in the seminal work by Duffie (1996), one reason why transactions may be trading 'on special' is the strong demand for collateral. Figure 7 shows the composition of funding- and collateral-driven transactions if we classify transactions with general collateral baskets as funding-driven and only those transactions with specific collateral where the repo rate is at least 10 basis points below the policy rate as collateral-driven. According to this definition, transactions with specific collateral but repo rates closer to the policy rate, are neither clearly collateral-driven nor clearly funding-driven, and are therefore excluded from Figure 7. In this case, collateral-driven transactions are still dominant across both currencies. However, it is also noticeable that, following this definition, there has been a slight upward trend in the importance of funding-driven transactions since mid-2022 which coincides with the ECB starting to reduce its balance sheet.

Figure 7: Funding- versus collateral-driven transactions based on specialness

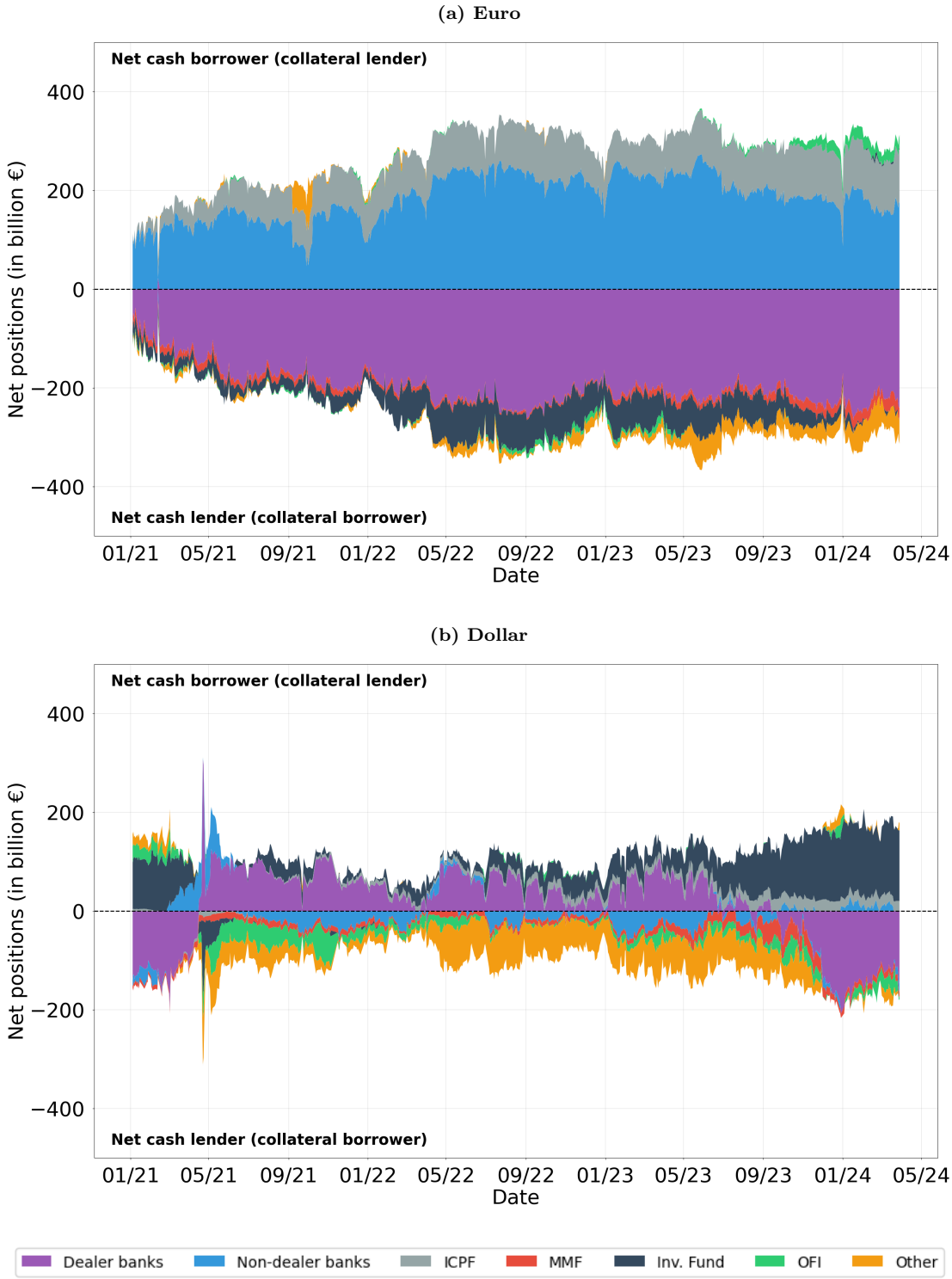


Note: A transaction is classified as collateral-driven when the collateral underlying is specific and the repo rate is at least 10 basis points below the deposit facility rate. All other transactions with specific collateral are not considered here. A transaction is classified as funding-driven when the collateral underlying is general. Sample period: 2021-01-01 – 2024-01-01

The general finding that EUR trades are predominantly collateral-driven has been documented in the literature (see for example Brand, Ferrante, and Hubert de Fraisse, 2019; Schaffner, Ranaldo, and Tsatsaronis, 2019; Bassi, Grill, Hermes, Mirza, O'Donnell, and Wedow, 2024). However, the composition of cash- and collateral-driven trades in USD transactions involving euro area entities has not been studied. One could extrapolate from the literature looking at US entities only. For example, D'Amico, Fan, and Kitsul (2018) find that the bilateral repo market among US market participants is dominated by transactions with specific collateral, while the triparty market is for funding purposes. Moreover, Baklanova, Caglio, Cipriani, and Copeland (2019) argue that the bilateral repo market represents half of the overall repo activity. Thus, the dollar market should have a share of collateral-driven transactions of approximately 50%. However, our results show that when euro area entities are involved in dollar-denominated transactions, the collateral motive dominates, accounting for 65%.

While collateral-driven transactions dominate both euro- and dollar-denominated transactions, the positioning of entities involved in these transactions differs significantly. Figure 8 presents the net outstanding positions of different sectors for euro- and dollar-denominated collateral-driven transactions. Positive values indicate net cash borrowers (or equivalently: collateral lenders), whereas negative values denote net cash lenders (or equivalently: collateral borrowers).

Figure 8: Outstanding net positions in transactions with specific collateral by sector



Note: The graphs show outstanding net positions in transactions with specific collateral. Net positions are calculated as cash borrowing volume - cash lending volume. (a) shows net positions in euro-denominated transactions by sectors, whereas (b) shows net positions in dollar-denominated transactions by sector. A positive value indicates that this sector type is a net cash borrower. Sample period: 2021-01-01 – 2024-01-01

Figure 8a shows that non-dealer banks and ICPFs are the primary lenders of euro-denominated collateral, with dealers and investment funds emerging as significant borrowers of euro collateral. For dollar-denominated transactions, the picture is markedly different. Dealer banks, which typically act as net lenders of dollar collateral, reversed this trend in 2024, becoming net borrowers of collateral.[21] However, the most striking development is the growing net collateral lending position of investment funds, which have become the largest net lenders of dollar collateral (Figure 8b). This is in line with Copeland and Kahn (2024) who show that hedge funds are the dominant player delivering Treasuries when sourcing cash. Indeed, according to our data, we observe a notable increase in this type of activity since mid-2023, in line with the rising incentives to engage in the cash futures basis trade (see also Kashyap, Stein, Wallen, and Younger, 2025). This pattern is in stark contrast to their behavior in euro-denominated collateral-driven transactions, where they act as net collateral borrowers. This shows that even though the collateral-driven motive dominates in both currencies, the net positions of different types of entities, especially nonbanks, can differ strongly.[22]

Table IV allows us to understand the differences in cash- and collateral-driven transactions in more detail. It shows a linear probability model where the dependent variable is a binary indicator for whether a transaction is cash- or collateral-driven. We can observe that dollar-denominated transactions are more funding-driven than euro-denominated transactions for almost all dimensions, but there is still variation in that. Specification (2) shows that when dealers are lending cash, the difference between euro- and dollar-denominated transactions shrinks considerably. A similar effect appears in specification (5) which has bilateral transactions as the baseline. In fact, specifiation (6) shows that in bilateral transactions in which a dealer bank is lending cash, euro- and dollar-denominated transactions do not differ in terms of funding- versus collateral driven.

These patterns have implications for both market functioning and policy. First, it shows the large role that NBFIs have come to play in the repo market (either as a source of leverage or as a safe and liquid store of wealth). Their trading strategies, however, can differ

[21] Dealer banks' shift to net collateral borrowing in dollar repo transactions coincides with swap spreads turning negative, reflecting the compensation dealers require for absorbing large volumes of Treasury collateral onto their balance sheets and incurring the associated funding and balance-sheet costs (Aquilina, Schrimpf, Sushko, and Xia, 2024).

[22] For more details on cash-driven transactions, refer to Figure F9.

Table IV: Estimated Effect of Currency on Collateral-Driven Indicator

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
USD	-0.16***	-0.04*	-0.20***	-0.16***	-0.06**	-0.01	-0.04**	0.01
	(0.03)	(0.02)	(0.03)	(0.04)	(0.03)	(0.02)	(0.02)	(0.02)
Controls								
Lend sector (*dealer*)		Y				Y		Y
Borr sector (*dealer*)			Y				Y	Y
Intragroup				Y				Y
Clearing type (*bilateral*)					Y	Y	Y	Y
Volume	Y	Y	Y	Y	Y	Y	Y	Y
Maturity	Y	Y	Y	Y	Y	Y	Y	Y
Date FE	Y	Y	Y	Y	Y	Y	Y	Y
Constant	0.97***	1.00***	0.97***	0.95***	0.96***	0.99***	0.97***	0.95***
	(0.01)	(0.00)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.04)
Obs.	30,402,873	30,402,873	30,402,873	30,402,873	30,402,873	30,402,873	30,402,873	30,402,873
R^2	0.08	0.31	0.10	0.10	0.50	0.53	0.51	0.54

Note: The underlying regression is $\text{CollateralDriven}_{it} = \alpha + \beta \cdot USD_{it} + \boldsymbol{\delta}'\mathbf{X}_{it} + \mu_t + \varepsilon_{it}$, where $\text{CollateralDriven}_{it}$ is equal to 1 if the underlying collateral is specific, and 0 otherwise, USD_{it} is a dummy variable equal to one if transaction i on date t is denominated in dollars. Baseline categories: lender sector = dealer; borrower sector = dealer; clearing = bilateral. Standard errors are clustered by counterparty-pair and reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Sample: 2021-01-01 – 2024-04-01.

strongly by currency denomination (e.g., see Bassi, Hermes, Kördel, Lenoci, Pizzeghello, and Sowiński, 2024, who show that the direction of the basis trade is opposite in the US Treasury and euro area government bond market). Second, while the collateral motive is dominant in both currencies, it is even stronger in euro repos, implying that measures to address aspects such as collateral scarcity will differ in their effectiveness depending on the currency of a transaction (see Greppmair and Jank, 2023, who show that securities lending facilities can alleviate asset scarcity). However, this pattern is not uniform and can differ depending on clearing type and counterparty types involved. Lastly, these findings imply that supervisors tracking the build-up of vulnerabilities have to take into account that the underlying economic reasons for engaging in repo vary notably across different players and over time.

3.4. Internal capital markets are behind a significant amount of cross-border repo activity

We continue our analysis by examining the role of intragroup transactions and their role in euro and dollar repos. In an intragroup transaction, two entities that belong to the same parent group engage in a repo transaction. For example, this could be a repo transaction be-

tween the investment banking arm and the commercial banking arm of the same bank holding group. These transactions form part of internal capital markets of banking groups and have a very different structure compared to other transactions because the competitive position of an entity is less important in determining the terms of the trade. Furthermore, intragroup transactions can be treated preferentially under the Capital Requirements Regulation (CRR II). For example, intragroup exposures may be exempted from prudential requirements such as limits to large exposures, provided specific conditions are met.

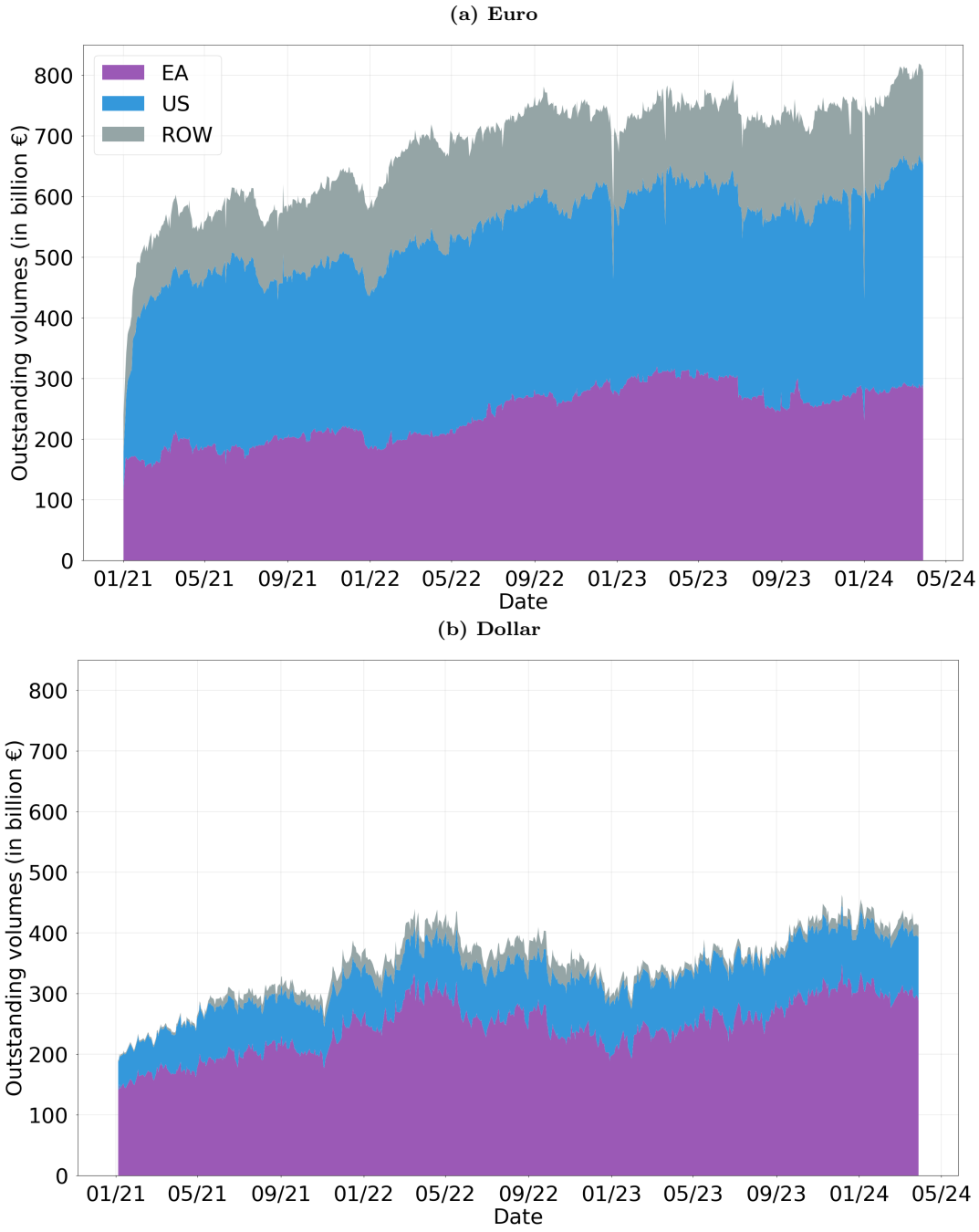
Figure 9 illustrates the evolution of intragroup transactions for euro and dollar-denominated outstanding repos in our sample and shows that such trades are substantial: Intragroup transactions account for approximately €700 billion of outstanding volumes in euro transactions, and €350 billion in dollar transactions.

Figure 9a shows that in intragroup transactions in euros, the euro area and US banking groups have nearly equal outstanding volumes. Intragroup transactions are, therefore, not only a tool for euro area banks to shift funding within the banking organization but are also extensively used by US banks in their euro operations. This suggests that US banking groups utilize their internal networks to reallocate euro liquidity or collateral across their subsidiaries. Meanwhile, in dollar-denominated intragroup transactions (Figure 9b), euro area banking groups clearly dominate, while US banking groups appear less inclined to use intragroup transactions to provide their euro area arms with dollars or dollar collateral. These patterns highlight the differing reliance on internal capital markets between banking groups, shaped by currency preferences and organizational structures.

Next, we consider the geography of intragroup funding flows. Figure 10 breaks down intragroup transactions between entities located in different currency areas. We observe that intragroup transactions in euros are dominantly conducted either within the euro area or between the euro area and Great Britain, documenting the outsized role that UK-based entities play within continental euro area banking groups. Euro transactions between UK and US entities are negligible, however. In contrast, we observe substantial flows between the UK and the US for dollar-denominated transactions. Direct intragroup flows from the US to the euro area, on the other hand, are relatively small, indicating that most of euro area banks' dollar funding is channeled through UK subsidiaries.

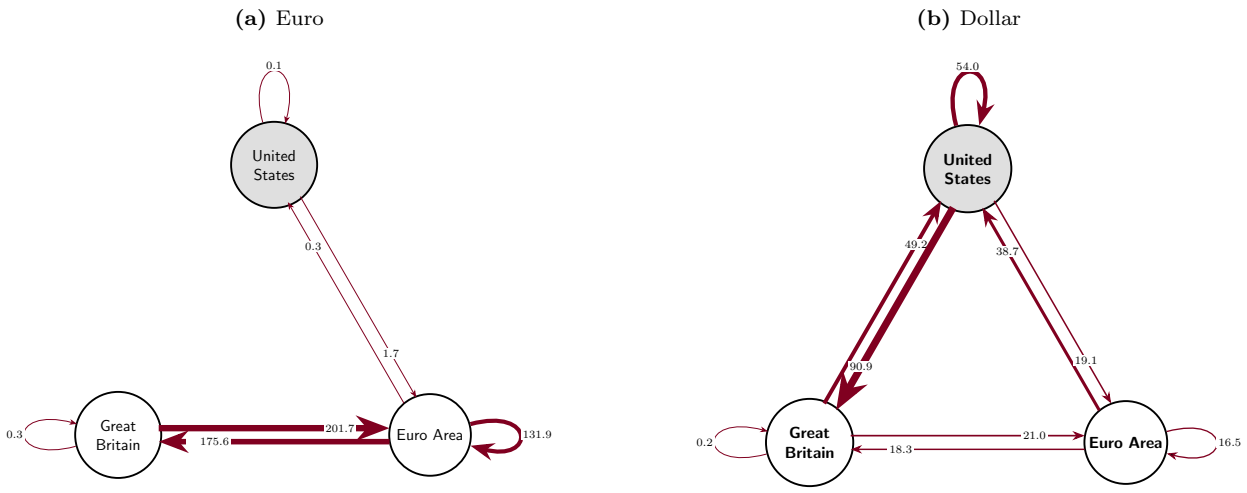
Table V further shows that intragroup transactions are concentrated in shorter maturities,

Figure 9: Outstanding volumes of intragroup transactions by banking group nationality



Note: The graphs show outstanding volumes of intragroup transactions by nationality of the banking group. The categories are the euro area (EA), the United States (US), and the rest of the world (ROW). This only includes non-centrally cleared transactions. Sample period: 2021-01-01 – 2024-01-01

Figure 10: Outstanding intragroup flows by currency



Note: This figure shows the flow of cash in intragroup transactions. Thus, the arrows are pointing from the cash-lender to the cash-borrower. The numbers are based on daily averages in outstanding data and are in billion euros. Sample period: 2021-01-01 – 2024-04-01.

especially in the case of euro-denominated transactions. The share of overnight transactions almost doubles in euro-denominated outstanding intragroup transactions, when benchmarked to their share in all transactions.[23] A likely reason for this finding is that banking groups use intragroup transactions primarily for very short-term liquidity management within the group (as discussed in, e.g., Cetorelli and Goldberg, 2012a).

Although internal capital markets in general have received considerable attention in the literature (see for example Campello, 2002; De Haas and Van Lelyveld, 2010; Cetorelli and Goldberg, 2010, 2012b,a; Houston, Lin, and Ma, 2012), prior studies have not focused on the role of repo in these internal markets. Our findings on the size, jurisdictional breakdown, and directionality of these markets are hence new to the literature. Moreover, our finding provides new evidence on how global banks structure their repo operations, complementing the work of McGuire, von Peter, and Zhu (2024) or Hardy, McGuire, and von Peter (2024).

The substantial role of intragroup transactions has a bearing on how shocks propagate through the financial system. On the one hand, such markets may play a role in dampening funding stresses in particular locations. On the other hand, disruptions in the functioning of internal markets themselves may leave banks scrambling for alternatives at times of stress,

[23]Note that these numbers differ slightly from those reported in section 3.2 for Fact 2, because we do not consider open terms in that analysis.

Table V: The difference in maturity distribution between all transactions and only intragroup transactions based on outstanding volumes

	EUR		USD	
Maturity bucket	all	intragroup	all	intragroup
overnight	21.93%	44.61%	40.80%	49.68%
one week	7.90%	3.17%	6.92%	3.91%
one month	22.77%	11.71%	13.60%	10.09%
three month	13.21%	8.36%	11.35%	6.62%
>three month	18.42%	16.58%	9.68%	1.97%
open term	15.77%	15.56%	17.66%	27.73%

Note: The shares are based on non-centrally cleared transactions. The 'all' columns show the maturity distribution overall for the respective currency, whereas the intragroup columns show the distribution for the subset of intragroup transactions. Sample period: 2021-01-01 – 2024-04-01

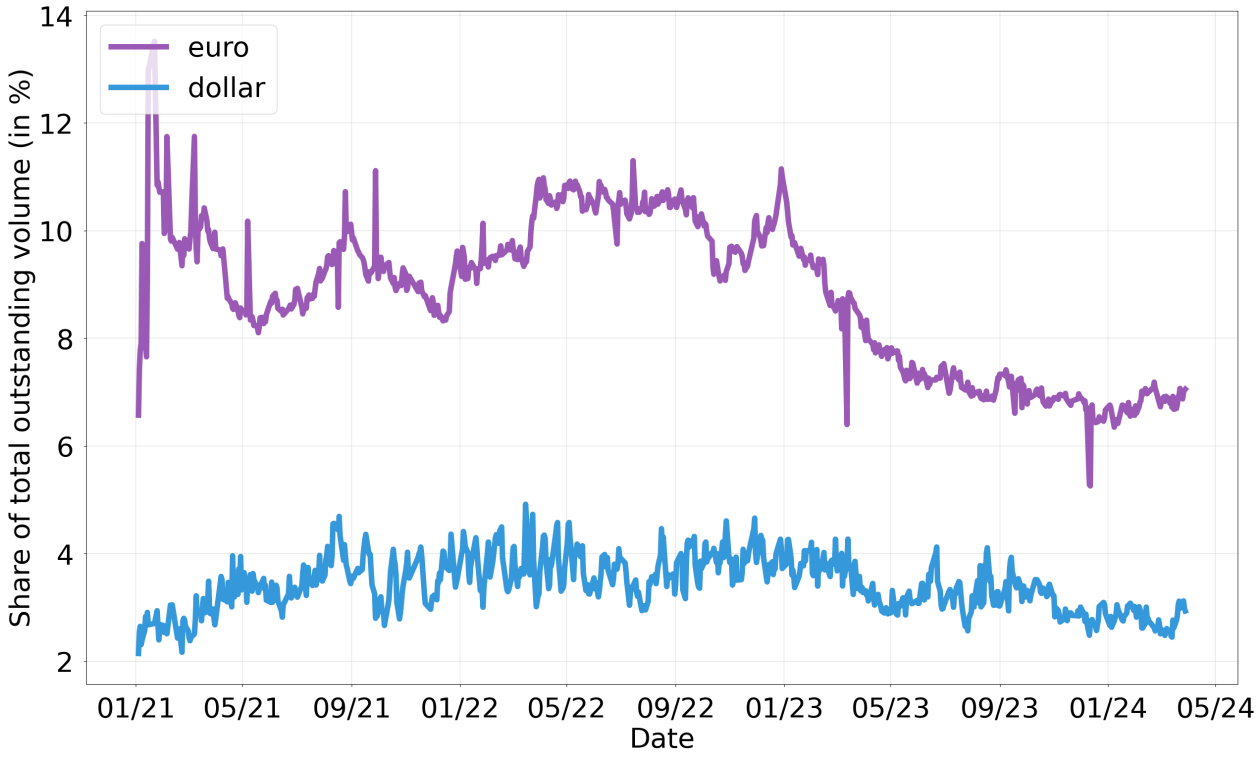
with possible broader spillover effects. In this regard, the heavy reliance on UK subsidiaries for both EUR and USD transactions highlights potential vulnerabilities in the post-Brexit financial landscape. Internal capital markets may also incentivize banks to exploit cross-border regulatory fragmentation, potentially magnifying vulnerabilities if these internal flows become impaired (Claessens, 2019). Moreover, the complexity of intragroup structures underscores ongoing challenges for cross-border resolution frameworks, making coordinated supervision essential to mitigate systemic risks effectively (Financial Stability Board, 2021). The importance of coordinated information sharing and supervision of banking groups' repo activities across jurisdictions thus becomes even more pertinent.

3.5. Negative haircuts are a common feature of repo markets

The fifth stylized fact is that there is a surprisingly large share of transactions with zero or negative haircuts. Specifically, Figure 11 shows the share of outstanding volumes that can be attributed to transactions with negative haircuts. We find that such transactions are more common in euro transactions (on average 9% of outstanding volumes), but they are also consistently present in dollar-denominated transactions (on average 4% of outstanding volumes). Figure 11 also shows a large time variation in the share of outstanding volume with negative haircut transactions within euro-denominated volumes that represent up to 14% at the beginning of our sample in 2021.

Economic intuition and conventional wisdom would imply that haircuts should be positive

Figure 11: The share of negative haircut transactions in outstanding volumes



Sample period: 2021-01-01 – 2024-04-01

or at least zero. This is because they are generally understood to be a risk management tool to protect lenders against potential collateral value fluctuations and/or counterparty default. From this point of view, haircuts are key in the literature on leverage spirals, where increasing haircuts can lead to forced asset sales and exacerbate a crisis (Gorton and Metrick, 2010; Copeland, Martin, and Walker, 2014; Krishnamurthy, Nagel, and Orlov, 2014).[24] However, negative haircuts do not fit the conceptual framework of this literature, although our data suggest that they are a pervasive feature of international repo markets.

However, intuitively, negative haircuts can still make sense for several reasons. First, in connection with Fact 4, haircuts might reflect preferential terms set within intragroup transactions. Entities conducting repo transactions internally within the same corporate group might apply negative haircuts to benefit the collateral-providing entity. This is evident in euro-denominated transactions, where Figure 12 shows that almost 30% of intragroup trans-

[24]Moreover, while theoretical work on haircuts is scarce, the model in Gottardi, Maurin, and Monnet (2019) argues that haircuts increase in counterparty risk and asset risk. However, they focus only on nonnegative haircuts, so their framework is not applicable to our findings.

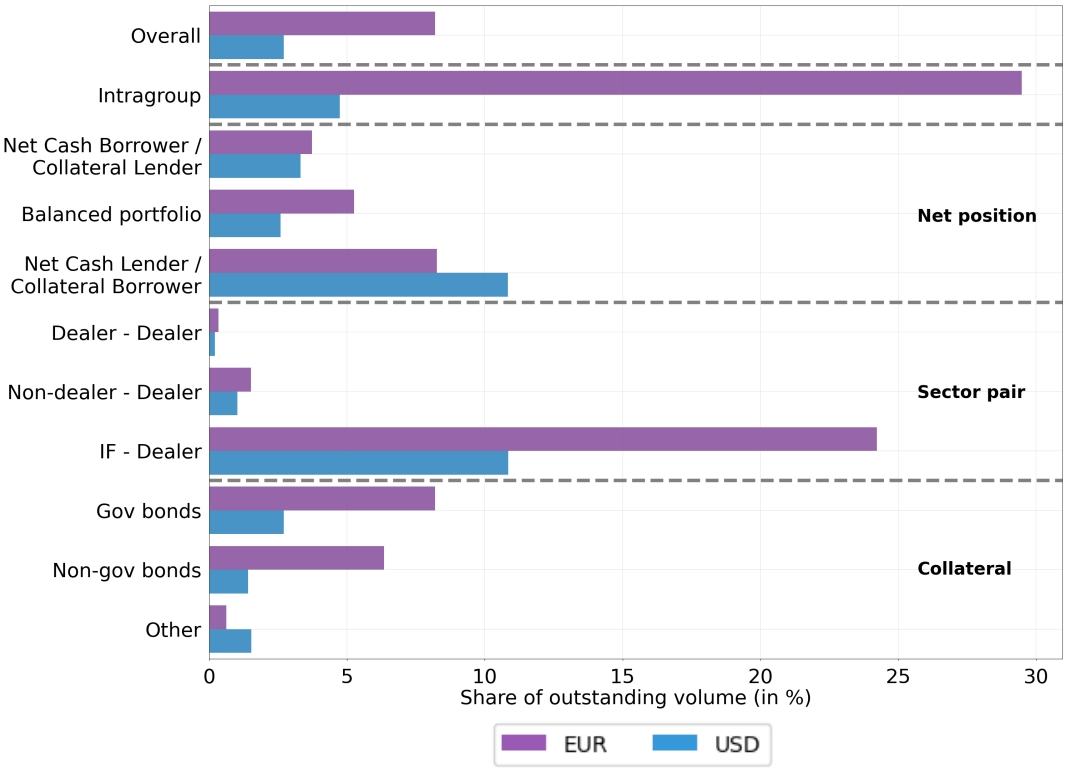
actions feature negative haircuts. However, negative haircuts persist even after accounting for intragroup activities, suggesting other reasons for their occurrence as well.

Second, market power can matter for haircuts. While a positive haircut protects the cash lender (collateral taker) from default of the cash borrower (collateral provider), negative haircuts can be seen as protecting the cash borrower (collateral provider) from losing access to a specific piece of collateral. Depending on the bargaining positions of the counterparties, one of the two motives might dominate. We find that dealers typically avoid accepting negative haircuts when lending cash due to their substantial bargaining power, especially over nonbank financial institutions (NBFIs). Figure 12 indeed shows that negative haircuts occur predominantly when dealers borrow cash from entities such as investment funds, while this is much less the case when dealers borrow from other dealers. Thus, one way to interpret these results is that dealers are leveraging their stronger market position to secure beneficial terms.

Third, specific collateral demand and portfolio-level management can be linked to negative haircuts. If a certain piece of collateral is in high demand ("on special"), the cash borrower (provider of the collateral) might be able to negotiate terms in which more cash must be provided than what the collateral is worth. Depending on the needs of the cash borrower, this could be preferable to negotiating a low interest rate, or could even be achieved in tandem with low interest rates. Figure 12 shows that negative haircuts are more common for euro area government bonds compared to assets like US Treasuries, consistent with the recent scarcity observed in the euro area government bond market (Nguyen, Tomio, and Vari, 2023). However, some entities might be able to mitigate negative haircuts by managing collateral at the portfolio level rather than individually per trade, which means that they balance their collateral needs across multiple simultaneous transactions. This can explain the dominance of zero haircuts because positive and negative haircuts can be offset (Hempel, Kahn, Mann, and Paddrik, 2023). Figure 12 shows that net lenders, i.e., entities with pronounced collateral demand such as investment funds in euro-denominated transactions, have more negative haircuts. In contrast, net borrowers, i.e., entities with pronounced liquidity demand such as ICPFs, and entities with a more balanced portfolio, have less negative haircuts.

One objection to these interpretations might be that haircuts and repo rates are set jointly at trade initiation so that, e.g., a negative haircut might simply go hand in hand with a higher

Figure 12: Transactions with negative haircuts in the cross section



Note: This chart shows shares of outstanding volumes with negative haircuts for different subsets of the data. It considers non-cleared transactions. The first bar shows the share of outstanding volumes with negative haircuts for all intragroup transactions. For all remaining shares shown in the figure (starting with "Overall"), intragroup transactions are excluded, and the sample is restricted to having government bonds underlying, and the maturity of the transaction is 1 day (overnights). The second bar shows the overall share of negative haircuts distinguished only by currency. The next set of bars ("Net position") groups entities into net cash-borrowers (collateral providers), net cash-lenders (collateral takers), and those entities that have a balanced portfolio. Net borrowers (lenders) are those entities whose cash borrowing (lending) volume accounts for more than 65% of their total volume. The fourth set of bars ("Sector pair") considers counterparty pairs where the left label refers to the cash-lender (collateral taker) and the right label to the cash-borrower (collateral provider). The fifth set of bars ("Collateral") shows the share of negative haircuts for different collateral types. Sample period: 2021-01-01 – 2024-01-01

repo rate to compensate for the higher risk for the cash lender. For completeness, we show in Figure H10 in the Appendix that this is an unlikely explanation. The correlations between haircuts and repo rates are positive for most of the sample splits, also underlying Figure and, in general, rather low. Hence, it is generally not the case that negative haircuts are accompanied by higher repo rates and, if anything, we rather observe the opposite pattern.

We empirically study the factors related to negative haircuts in more detail in Section 4.2.

Our detailed account of negative haircut repos significantly expands upon the few existing

papers that mention the presence of negative haircuts. Using US data, Baklanova, Caglio, Cipriani, and Copeland (2019) mention that haircuts can be negative because securities lending agents demand securities loans to be secured by cash that exceeds the value of the security, while Hempel, Kahn, Mann, and Paddrik (2023) find that negative haircuts are mostly present when dealers do repos with hedge funds. Both of these arguments confirm our finding on the importance of the underlying collateral. However, negative haircuts are not the focus of these papers. Moreover, to the best of our knowledge, no paper with euro area data has documented facts about negative haircuts. The empirical analysis in Section 4.2 is the first to comprehensively document and empirically test the channels through which negative haircuts arise. In particular, we are the first to show that intragroup transactions are one of the key drivers for these patterns. Lastly, we show that counterintuitively, it is not always overnight transactions that are most prone to negative haircuts.

Our findings have direct implications for future research. For theoretical models of the repo market, our results strongly suggest to not simply assume away negative haircuts and the need to account for institutional features like internal capital markets, market power, collateral demand, as well as currency-specific effects.[25] For empirical work with less detailed datasets, our results suggest that negative-haircut trades should not be treated as outliers but rather are a strong indicator of intragroup transactions.

4. Analytical deep-dives

In this Section, we utilize the richness of the SFTDS and apply insights from the previous section to two important questions. First, we investigate the passthrough of US monetary policy to repo rates. Second, we dig deeper into the drivers of negative haircuts (Fact 5) and quantify the relative importance of intragroup transactions, market power, collateral, and maturity.

[25] For example, in models of the type developed by Coen, Coen, and Hüser (2024) the inclusion of non-zero haircuts, and in particular negative haircuts, could provide an even richer insight into the trade-off between funding needs and collateral demand.

4.1. Monetary policy passthrough

We start by testing how US monetary policy passes through to both euro- and dollar-denominated repo rates. Our goal is to show how effectively US monetary policy transmits to dollar transactions as well as to zoom in on global spillovers of US monetary policy.

Specifically, following Eisenschmidt, Ma, and Zhang (2024), we measure the passthrough efficiency of monetary policy by quantifying the extent to which changes in the Federal Reserve's target rate (analogous to the ECB's Deposit Facility Rate (DFR) in their context) are transmitted into repo rates. The passthrough from the Federal Reserve target rate to repo rates, indexed by collateral k, is defined as:

$$\text{Passthrough}_k^{\text{Fed Funds Rate}\rightarrow Repo} = \frac{Rate_k^{Repo,post} - Rate_k^{Repo,pre}}{\Delta\text{Fed Funds Rate}} \tag{1}$$

where $Rate_k^{Repo,pre}$ and $Rate_k^{Repo,post}$ represent the volume-weighted average repo rates backed by collateral ISIN k one week before and one week after a rate hike. In line with Eisenschmidt, Ma, and Zhang (2024), we exclude the transition period between the announcement and the implementation in order to capture the full passthrough. For dollar-denominated transactions, we consider the full rate hike cycle between 2022-23, whereas we focus on the first three rate hikes in 2022 for euro-denominated transactions, in order to avoid overlaps with the rate hiking cycle of the ECB.

In order to ensure comparability, we only consider non-centrally cleared, non-intragroup transactions with overnight maturity and government bonds as collateral. Table VI shows the results of this analysis for three subsamples, depending on broad counterparty categories. When we write 'Bank to Nonbank' we refer to banks lending cash and receiving collateral from nonbanks, while 'Nonbank to Bank' refers to nonbanks lending cash and receiving collateral from banks.

First, we consider all transactions regardless of counterparty type. In euro-denominated transactions, we do not find a considerable passthrough from US monetary policy. However, there is considerable variation in this estimate as the 25th percentile shows a passthrough of -4% and the 75th percentile a passthrough of 4%. In contrast, dollar-denominated transactions exhibit a substantial, almost one-to-one, passthrough of about 94%. Here, the variation is smaller, as the 25th percentile shows a passthrough of 94% and the 75th percentile shows a

Table VI: passthrough of US monetary policy rate shifts

Category	Average	P25	P50	P75
EUR				
Overall	0.13%	-3.51%	0.00%	4.01%
Bank to Bank	5.24%	-2.00%	6.68%	11.76%
Bank to Nonbank	0.39%	-2.74%	-0.64%	4.24%
Nonbank to Bank	-0.10%	-2.53%	0.00%	4.00%
USD				
Overall	93.92%	93.62%	98.89%	103.50%
Bank to Bank	101.49%	97.33%	100.00%	101.89%
Bank to Nonbank	94.14%	93.59%	98.38%	102.89%
Nonbank to Bank	93.44%	93.36%	99.37%	104.06%

Note: This table shows the volume-weighted distribution of passthrough of the US monetary policy hiking cycle in 2022-2023 to euro- and dollar-denominated repo rates. Only non-centrally cleared and non-intragroup transactions, with one-day maturity and government securities as collateral, have been considered. The labels refer to the flow of cash. Thus, for example, Bank to nonbank refers to banks lending cash to nonbanks. Sample period: 2022-03-01 – 2023-08-01

passthrough of 104%.

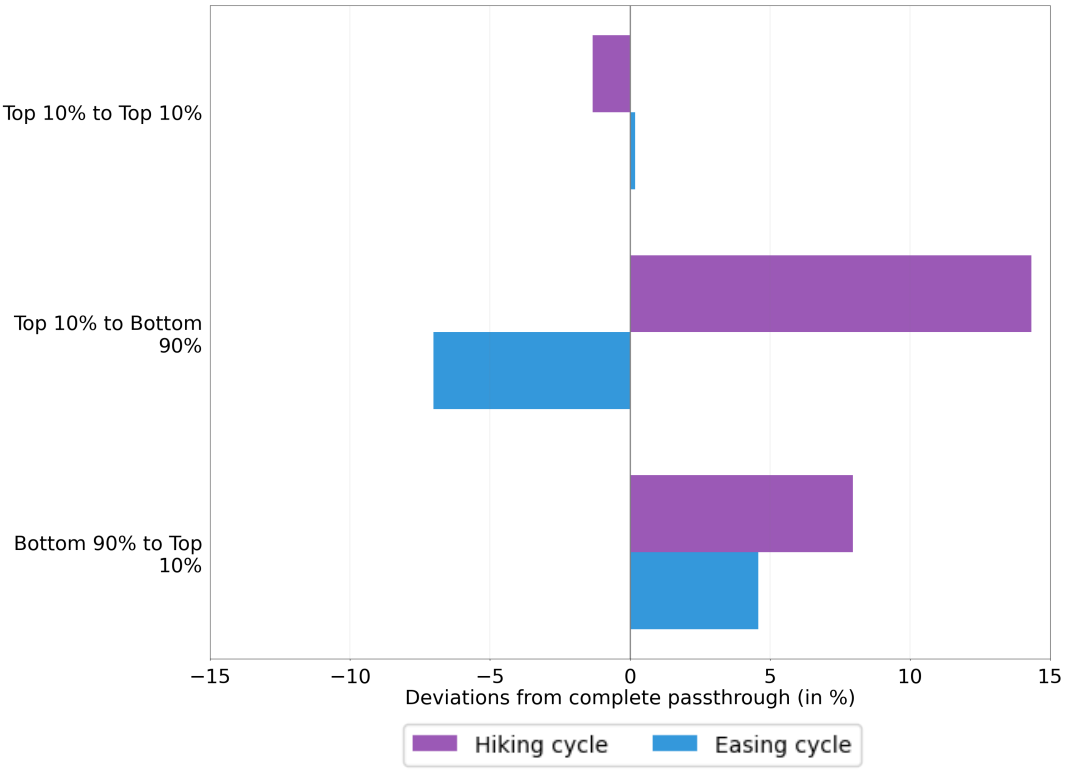
Second, we turn to bank-to-bank transactions. For dollar-denominated transactions, the passthrough is essentially perfect, around 101%. For euro-denominated transactions, we find a small spillover effect, amounting to roughly 5%. The 50th and 75th percentiles show even larger values of 7% and 12% respectively. This finding provides evidence of cross-currency spillovers, reinforcing our first stylized fact regarding the importance of dollar activities involving euro area entities.

Third, we analyze bank-to-nonbank and nonbank-to-bank transactions separately. The labels here refer to the flow of cash, such that, e.g., bank-to-nonbank means that banks are lending cash to nonbanks. Across both currencies, nonbank-to-bank transactions show lower passthrough than bank-to-bank transactions, potentially indicating banks' market power. Specifically, banks appear able to negotiate somewhat higher rates, on average, when lending cash and lower rates when borrowing cash.

Next, we dive deeper into dollar-denominated bank-to-bank transactions (Figure 13), distinguishing banks by size, and separating the effects of policy rate hikes and cuts. Overall, our findings suggest a role for bargaining power dynamics even within bank-to-bank transactions.

Regarding size-based differences, we define the top 10% of banks by repo borrowing and

Figure 13: Passthrough of US monetary policy across cycles



Note: This chart shows the deviation from complete passthrough of US monetary policy to dollar-denominated repo rates across hiking and easing cycles. Only bank-to-bank, non-centrally cleared and non-intragroup transactions, with one-day maturity and government securities as collateral, have been considered. The country refers to the nationality of a bank. The labels refer to the lending of cash. Thus, for example, US to non-US refers to US nationals lending cash to non-US nationals. Sample period: 2022-03-01 – 2025-01-01

lending volumes. Figure 13 shows the deviations of average passthrough from complete (100%) passthrough. Our results reveal that the largest banks exhibit market power relative to smaller banks. Specifically, when the largest banks transact among each other, passthrough is almost perfect with small deviations. However, during rate hikes, the largest banks on average raise rates above the actual policy hike when lending to smaller banks (passthrough of 114%). By contrast, in the face of rate cuts, they lower rates less than the policy cut (passthrough of 93%). Thus, larger banks appear to benefit from rate movements regardless of whether the Fed is in a hiking or easing cycle. When the top 10% banks are cash borrowers (collateral lenders) instead, we only see this beneficial position in rate cuts, where rates on average are reduced slightly more (about 4%) than the policy rate.

In sum, these analyses underscore significant heterogeneity in monetary policy passthrough

across currencies, counterparties, and bank size. They also indicate an important role for bargaining power for understanding market outcomes (see for example Huber, 2023; Hempel, Kahn, Mann, and Paddrik, 2023; Eisenschmidt, Ma, and Zhang, 2024, for more evidence of bargaining power in repo markets). The prominent role of the dollar as a funding currency is evident, with US monetary policy significantly affecting even foreign currency segments of the repo market.

4.2. Drivers of negative haircuts

The second empirical application takes a closer look at the three drivers of negative haircuts that we have identified under Fact 5 in a simple regression framework. Specifically, we are considering the effect of intragroup transactions, market power, and collateral demand. To do this, we run logit regressions with a binary indicator equal to one if a transaction has a negative haircut as the dependent variable. The full set of independent variables is detailed in Table I7 in the Appendix. We cluster standard errors by month and counterparty pair to account for two types of correlation in the error terms: market conditions in a given month that affect all transactions and persistent patterns in haircut negotiations between specific counterparty pairs.

Before we examine the three mentioned factors, we have to establish that negative haircuts are not a simple data error. Therefore, we begin by examining how central clearing and the underlying collateral type relate to negative haircuts. This is because central clearing eliminates counterparty risk, whereas general collateral implies that the cash-borrower is not concerned about losing access to a *specific* piece of collateral. Specification (1) in Table VII includes indicator variables for cleared transactions and general collateral usage. The results show that negative haircuts are significantly less likely in cleared transactions (coefficient -7.43) and those using general collateral (-3.41). These coefficients in the regression are log odds and can be converted to odds ratios. For central clearing, the coefficient of -7.43 translates into an odds ratio of 0.001, and for general collateral, the coefficient of -3.41 translates into an odds ratio of 0.033. This means that the odds of negative haircuts are 0.01% for central clearing and 3.33% for general collateral, assuming all other factors are held constant. In other words, we find negative haircuts to be virtually non-existent in centrally cleared transactions or in those with general collateral underlying. These results remain

Table VII: Logit regression results of general transaction characteristics on the likelihood of haircuts being negative

	(1)	(2)	(3)	(4)
Clearing	-7.43***	-8.10***	-8.49***	-8.52***
	(0.73)	(0.75)	(0.90)	(0.91)
General Collateral	-3.41***	-3.19***	-3.43***	-3.50***
	(0.72)	(0.73)	(0.83)	(0.84)
EUR		2.85***	3.02***	3.05***
		(0.38)	(0.48)	(0.48)
Time FE	N	N	N	Y
Controls				
Transactions size	N	N	Y	Y
Net exposure	N	N	Y	Y
Observations	21,836,287	21,836,287	21,836,287	21,836,287
Pseudo R^2	0.29	0.42	0.45	0.45

Note: This table presents logit regression results where the dependent variable is a binary indicator for negative haircuts. 'Clearing', 'General Collateral', 'Net exposure' and 'EUR' are dummy variables, indicating whether a transaction is centrally cleared, has general collateral underlying, has collateral posted for a portfolio of transactions rather than a single transaction or is denominated in euros, respectively. Transaction size is the natural logarithm of the cash amount exchanged, z-score normalized. The regression is based on the flow version of the data since the haircut is determined at the beginning of a transaction. End-of-month reporting dates have been excluded to avoid picking up window-dressing behavior. Time fixed effects are at a monthly frequency. Standard errors are clustered by month and counterparty-pair and reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Sample period: 2021-01-01 – 2024-04-01

robust when including a binary indicator for whether a transaction is euro-denominated (Specification (2)), as well as when we include control variables for the transaction size and whether collateral has been posted for net exposure rather than for a single transaction[26] (Specification (3)) and time fixed effects (Specification (4)).

These findings suggest that negative haircuts are unlikely to be a simple data error. We thus focus the rest of our analysis on non-centrally cleared transactions with specific collateral underlying.

We now examine in more detail the role of the three factors identified under Fact 5: Intragroup transactions, market power, and collateral demand. In doing so, we consider euro and dollar transactions separately in Table I8 – I10 in the Appendix. The regressions maintain the same logit framework.

[26]When collateral has been posted for net exposure, the haircut is more difficult to interpret because a multitude of transactions could be included in its overall calculation.

Intragroup transactions. The first factor is whether a transaction occurs between two entities that belong to the same parent group, captured by an intragroup dummy variable. The coefficients in specification (2) for this indicator are large and significant for both currencies (for both euro and dollar, see Table I8) (log odds of 3.14 for the euro, 3.18 for the dollar or 23.10 and 24.10 in terms of odds ratios, respectively), suggesting that intragroup transactions are substantially more likely to have negative haircuts. The reason could be that negative haircuts often apply when liquidity is transferred internally from one entity to another while using relatively little collateral.

Market power. The second factor is testing for the impact of market power. We assume that dealer and potentially non-dealer banks might have market power. In the regression, we include dummy variables that equal one when the cash borrower is a dealer or a non-dealer bank, leaving the NBFI sector as the reference category. In both euro- and dollar-denominated transactions (Table I8), specification (3) shows that only dealers are more likely to receive negative haircuts. This would suggest that only dealers have market power, regardless of the currency. This effect is robust to accounting for intragroup transactions (specification (6) in Table I9). For both euro and dollar transactions, including a dealer×intragroup interaction term still leaves the standalone dealer effect positive and significant (log odds of 2.11 in euro, or odds ratio of 8.25, and log odds of 2.50 in dollar, or odds ratio of 12.18). Overall, this result suggests that only dealer banks hold genuine market power relative to nonbanks, and that this is more pronounced in dollar-denominated transactions.

Collateral demand. The third factor is the type of security that is underlying as collateral and its specialness. We include dummy variables for different security types, using government securities as the reference category. Specification (3) shows that generally, transactions with collateral that is trading on special is more likely to have a negative haircut (log odds of 1.65 for euro and 2.84 for dollar, or odds ratios of 5.21 and 17.13 respectively). Specification (4) in Table I8 shows that for euro transactions, almost all non-government securities are associated with higher probabilities of negative haircuts (log odds ranging from 0.71 to 4.61, or odds ratios from 2.03 to 100.36). This is robust to interacting the security types with an indicator for specialness (Specification (11) in Table I10). This pattern aligns with the notion that when securities are in high demand, cash lenders will have to pay more to obtain

these securities, and at least some of this "overpaying for specialness" may be reflected via negative haircuts.

This analysis shows that negative haircuts are a structural feature of both the euro and dollar repo market. Furthermore, persistent differences between euro- and dollar-denominated transactions, such as differences in maturity or the significance of intragroup transactions, can have a significant impact on market structure.

5. Conclusion

We study the anatomy of the international dimension of repo markets based on a new regulatory micro-level dataset. The importance of the international repo market, as a successor to the (unsecured) Eurodollar market, has grown steadily since the Global Financial Crisis, and our paper is the first to provide a comprehensive account of its key characteristics, players, and trading outcomes.

Our results are structured around five key facts. Some of these facts provide new evidence on repo markets, especially on their international dimension, whereas other facts either challenge or put into perspective earlier evidence from the literature.

Specifically, we provide evidence supporting 5 key take-aways:

1. that repo markets are deeply integrated across the Atlantic, with a very large heft of the US dollar in the repo activities of euro area banks. Put differently, we find little evidence for segmentation or home bias.

2. that longer-term tenors (beyond overnight) are highly common and build up to large outstanding positions, especially in euro and non-centrally cleared transactions. This funding puts into question the common perception in the literature of repo essentially being an overnight market.

3. that there has been a sizable shift towards collateral-driven transactions with a growing role for nonbank financial institutions (NBFIs). The latter increasingly rely on repo, either as a source of leverage, like in the case of hedge funds, or as a means to safely deploy cash. Again, there are stark differences between currencies, with a larger role

for collateral-driven motives in euro transactions, possibly due to less homogeneous collateral in the euro area compared with the US.

4. that there has been a growing role for intragroup transactions, in which banks move funding between branches or subsidiaries—yet another manifestation of the international dimension of repo. While internal capital markets as such are well known from the earlier literature on global banking, we are the first to document their size and role in repo markets.

5. that transactions with zero and even negative haircuts are quite common in international repo markets. These findings challenge the conventional view that haircuts solely exist as a risk management tool.

These facts lend themselves to novel avenues for future research on the drivers and mechanisms that generate these facts. We provide two empirical deep-dives that explore specific implications of our results. Given the outsized role of the US dollar in euro area repo markets, we study the role of US monetary policy spillovers to euro repo rates. We document significant spillovers and heterogeneity in the passthrough of US monetary policy to different counterparty types. Drawing on our findings on the prevalence of negative haircut transactions, we show that the phenomenon can largely be traced back to a combination of market/bargaining power, demand for specific collateral, and the existence of internal capital markets.

The stylized facts presented in this paper also have several implications for policymakers. For example, the high share of USD repos and the large market share of longer-term repo tenors are crucial for assessing market stability and funding risks in a currency area. As another example, the significance of intragroup transactions regardless of currency suggests a blurring of jurisdictional borders when assessing funding market stability in a currency area and the need for a global, integrated monitoring and supervisory approach.

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Appendix for

"The international dimension of repo: Five new facts"

Felix Hermes Maik Schmeling Andreas Schrimpf

A. Data cleaning

We have employed considerable data cleaning in order to ensure the robustness of the data.

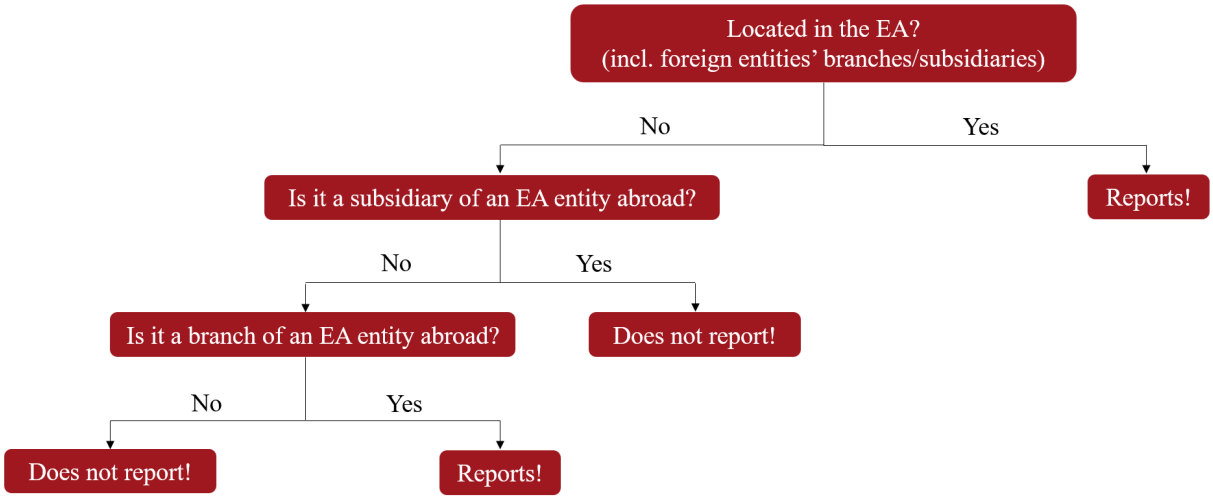
Deduplication. First, and most important, we deduplicate the data. Since reporting under SFTR implies that *all* entities must report all their SFTs, the data feature double counting. This can become increasingly complex if one of the counterparties to a transaction is not a reporting entity, or when CCPs are involved, which also have a reporting requirement. In the latter case, we can have up to six reports for the same transaction. We have contributed to and make use of the ECB's deduplication approach, which has been developed in the Directorate General Macroprudential Policy and Financial Stability. Due to this, every transaction is only recorded once in the final dataset that we use in our paper.

Data cleaning. Beyond deduplication, we have taken several steps to clean the data. First, we have ensured consistent timing of transactions. This means, for example, that we only consider transactions that have not yet matured and exclude those that have not yet settled. Second, we have removed transactions with unrealistic terms, e.g., transactions that have a volume above €100 billion and transactions in which the volume is multiple times larger than the total issue size of the underlying collateral. Third, we remove dates that are public holidays such as Easter or the US inauguration day, in which markets close in one or both jurisdictions (US or Euro Area). Fourth, we apply a filtering method that addresses a pattern in the data in which outstanding transactions are rolled over regularly with different terms, but the transactions with previous terms are never removed, leading to the accumulation of nearly identical transactions. Fifth, repo rates have been extensively cleaned, for example by identifying entities that temporarily reported rates in basis points instead of percentages, or by identifying transactions with clearly unrealistic rates (reporting errors).

B. Reporting requirements by location

The Figure below visualizes the reporting requirements underlying SFTDS (based on the SFTR). The regulation mandates all entities established within the European Economic Area (EEA), branches of EEA-established entities located outside the EEA, and branches of non-EEA firms located inside the EEA to report their Securities Financing Transactions (SFTs). SFTDS represents the euro area subset of these reports.

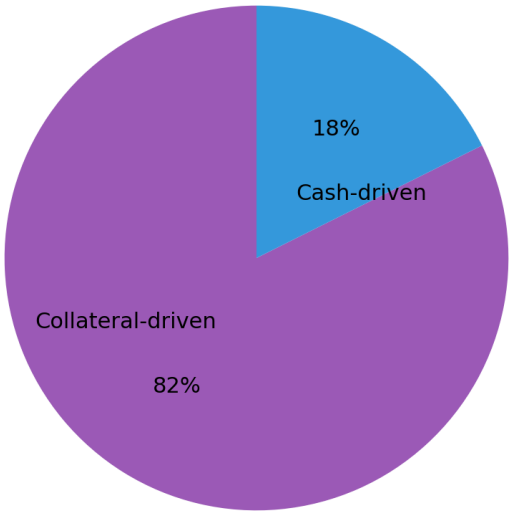
Figure B1: Reporting requirements in SFTDS



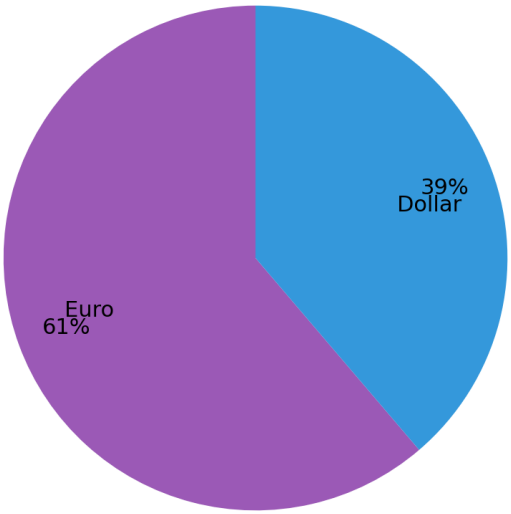
C. Descriptives

C1. Additional information on market structure

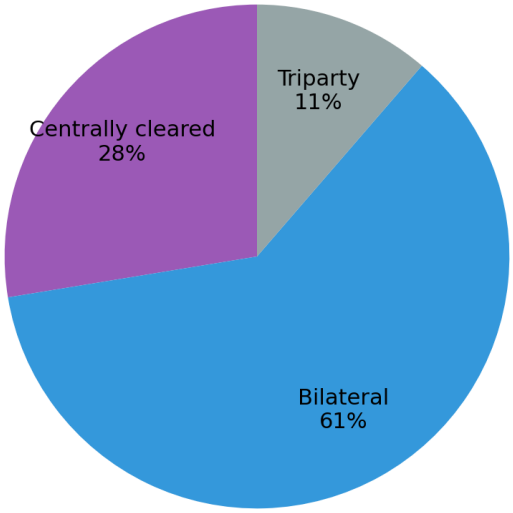
(a) Cash vs collateral driven



(b) Currency breakdown



(c) Clearing breakdown



Note: Collateral-driven are transactions with specific collateral underlying whereas cash-driven transactions have general collateral underlying.
Sample period: 2021-01-01 – 2024-01-01

Table C1: Estimated Effect on Transaction Size by Currency

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
USD	23.95***	26.36***	23.36***	43.61***	26.40***	21.62***	34.25***	27.97***
	(7.57)	(8.51)	(7.13)	(5.65)	(8.68)	(7.77)	(5.35)	(6.17)
Controls								
Maturity (*overnight*)		Y	Y	Y	Y	Y	Y	Y
Lend sector (*dealer*)			Y					Y
Borr sector (*dealer*)				Y				Y
Intragroup					Y			
Clearing (*bilateral*)						Y		Y
Collateral (*govs*)							Y	Y
Date FE	Y	Y	Y	Y	Y	Y	Y	Y
Constant	23.97***	24.39***	24.66***	25.55***	25.85***	21.37***	27.45***	40.55***
	(1.33)	(1.39)	(1.81)	(1.88)	(1.31)	(3.46)	(1.55)	(6.81)
Obs.	31,729,151	30,402,873	30,402,873	30,402,873	30,402,873	30,402,873	29,657,848	29,657,848
R^2	0.01	0.01	0.01	0.02	0.01	0.02	0.03	0.05

Note: The underlying regression is Transaction size$_{it} = \alpha + \beta \cdot USD_{it} + \boldsymbol{\delta}'\mathbf{X}_{it} + \mu_t + \varepsilon_{it}$, where USD_{it} is a dummy variable equal to one if transaction i, on date t, is denominated in dollars. Baseline categories: maturity = overnight; lender sector = dealer; borrower sector = dealer; clearing = bilateral; collateral = government securities. Standard errors clustered by counterparty-pair in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Sample: 2021-01-01 – 2024-04-01.

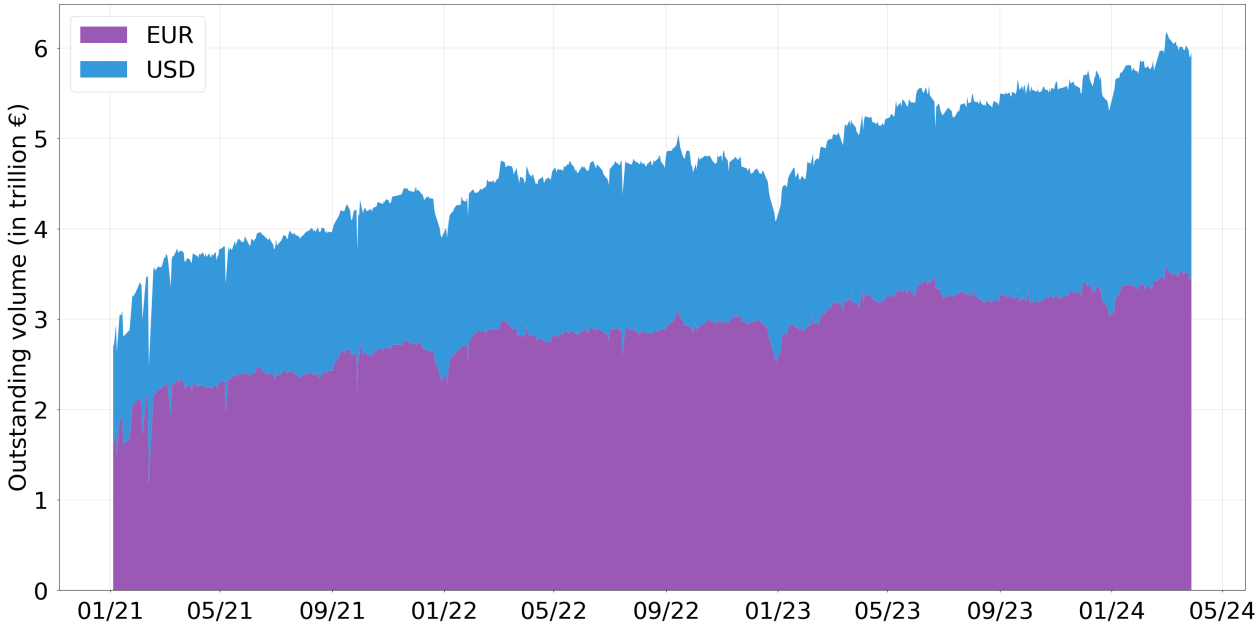
The results in Table C1 demonstrate that USD-denominated repo transactions are systematically larger than EUR-denominated transactions, even after controlling for various structural characteristics. The coefficient on the USD dummy variable is consistently positive and highly significant across all specifications, indicating that dollar transactions are approximately 22-43 million euros larger than euro transactions on average. This effect remains robust when progressively adding controls for maturity, sector composition, clearing arrangements, and collateral types, suggesting that the size differential is not driven by differences in these structural characteristics between USD and EUR repo markets. The baseline specification (column 1) shows that EUR transactions average 23.97 million euros in size, while USD transactions average 47.92 million euros (23.95 + 23.97). This substantial differential may reflect several factors specific to the euro area context: USD repos involving euro area entities likely serve different liquidity management purposes than domestic EUR repos, potentially requiring larger transaction sizes to justify the additional complexity and costs of

cross-currency operations. Additionally, the size premium they may reflect the concentrated nature of USD liquidity provision in the euro area, where fewer specialized dealers handle larger volumes to serve the broader market's dollar funding needs.

D. Fact 1

D1. Time series of euro- and dollar-denominated volumes

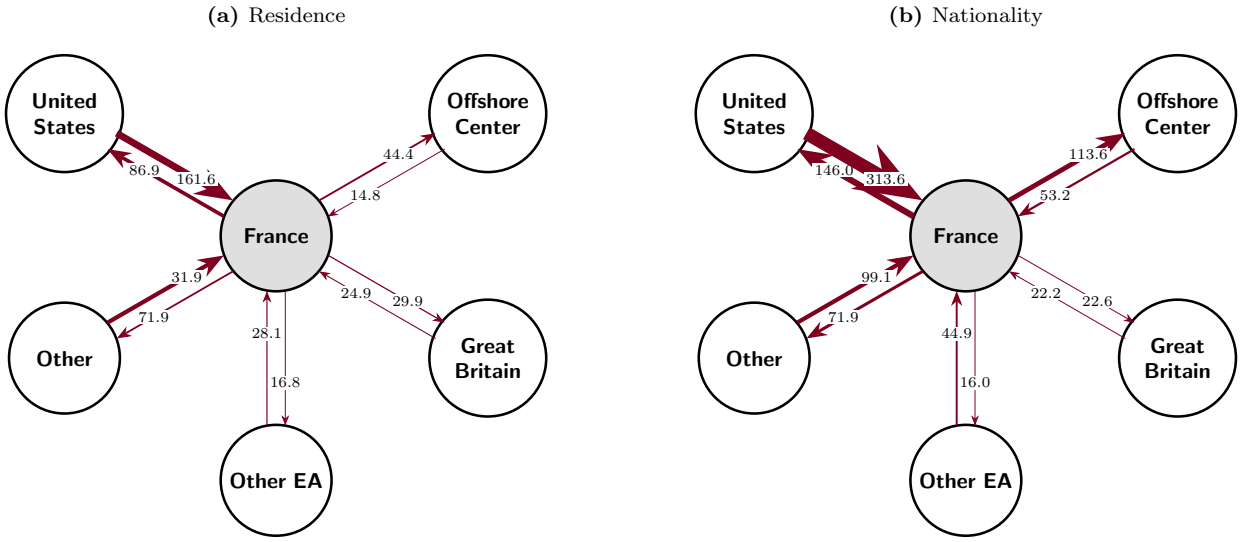
Figure D3: Outstanding volume by currency



Sample period: 2021-01-01 – 2024-04-01

D2. A Network of outstanding dollar transactions involving France

Figure D4: USD Outstanding cross-border flows involving France



Note: This figure shows the flow of cash in dollar-denominated outstanding transactions which involve French entities. Thus, the arrows are pointing from the cash-lender to the cash-borrower. The numbers are based on daily averages in outstanding data and are in billion euros. We distinguish by residence and nationality in line with McGuire, von Peter, and Zhu (2024). Moreover, 'Offshore Center' refers to the BIS's list of offshore centres (Pogliani and Wooldridge, 2022). Sample period: 2021-01-01 – 2024-04-01.

Table D2: Volume-weighted average maturity per connection

France:	Cash lending	Cash borrowing
Residence		
United States	27.27	9.95
Great Britain	71.54	46.13
Offshore center	48.30	28.02
Other EA	96.87	116.34
Other	85.83	36.72
Nationality		
United States	20.36	14.30
Great Britain	89.70	59.33
Offshore center	22.57	13.53
Other EA	106.55	53.44
Other	75.84	32.79

Note: This table shows the volume-weighted average maturities in days for every connection in the above network and distinguishing by cash-lending and cash-borrowing. Every connection is with France, so for example, the 'Cash lending' column and 'Great Britain' row show cash lending of France to Great Britain. Sample period:§ 2021-01-01 – 2024-04-01

Table D3: Regression of offshore and onshore transactions on repo rates

	(1)	(2)	(3)
Offshore	0.02***	0.01	0.025***
	(0.01)	(0.01)	(0.01)
Collateral × Date FE	Y	Y	Y
× borrower	N	Y	N
× lender	N	N	Y
Obs.	1,153,582	495,865	372,507

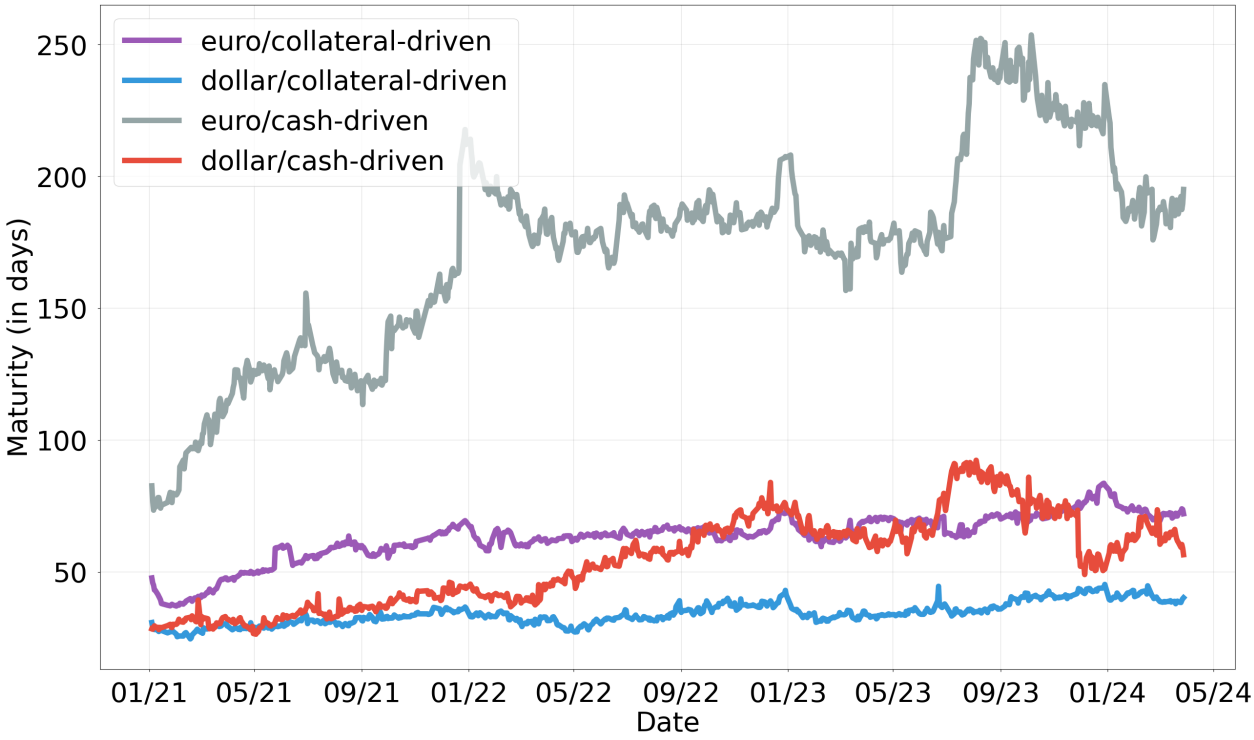
Notes: Dependent variable is the repo rate in percentage. 'Offshore' is 1 if both counterparties to a transaction are non-US residents and 1 otherwise. The sample is restricted to non-centrally cleared dollar-denominated transactions with US Treasuries as collateral, a maturity of one day and non-intragroup. Flow data is considered for this exercise. Standard errors, clustered by counterparty–pair, are in parentheses. *** $p < 0.01$. Sample period: 2021-01-01 – 2024-04-01.

Table D3 shows evidence for segmentation within dollar-denominated repos that involve euro area entities. In particular, specification (1) shows that given the same Treasury and date, there is a significant difference in USD repo rates in transactions that happen between two entities that are both US residents (onshore) and between two entities where at least one of them is a non-US resident (offshore). When including collateral × date × borrower fixed-effects, we find that from a cash-borrowing perspective, it does not matter whether the transactions is offshore or not. However, when we consider collateral × date × lender fixed-effects, rates tend to be higher. Thus, a given cash-lender might take into account whether the transaction is crossing borders or not.

E. Fact 2

E1. Maturities of cash- and collateral-driven transactions

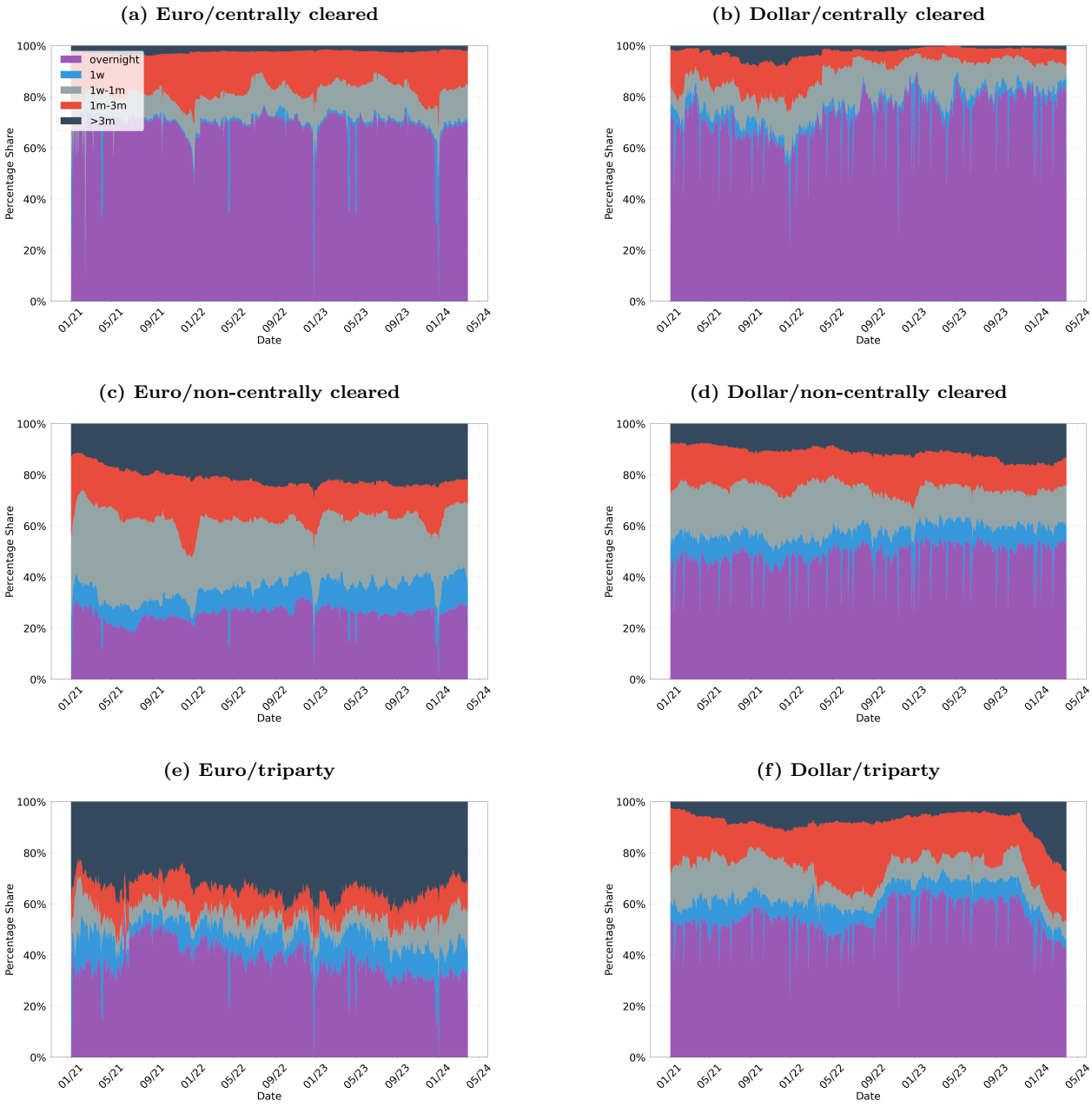
Figure E5: Volume-weighted average daily maturity of outstanding transactions by currency and collateral type in days



Note: This chart shows outstanding volume-weighted average maturities. Collateral-driven transactions have specific collateral underlying whereas cash-driven transactions have general collateral underlying. Maturities are truncated at the top 1.25% to account for outliers. Only fixed repos are considered as open repos do not have a maturity date. This considers non-centrally cleared transactions only since this is the market with considerable volume in all segments (see Figure D3), and with most variation in maturities (see Figure 4). Sample period: 2021-01-01 – 2024-04-01

We find that cash-driven outstanding transactions consistently have longer maturities than collateral-driven ones. This pattern is particularly pronounced in euro-denominated outstanding transactions. Dollar-denominated outstanding transactions show a similar pattern but with generally shorter tenors. We observe spikes in cash-driven transactions, whereas this is not the case in collateral-driven transactions. These spikes seem to relate to year-end reporting, where entities retract from the repo market temporarily. However, there are also spikes that do not relate to a reporting date, which could be related to monetary policy or other events in the market.

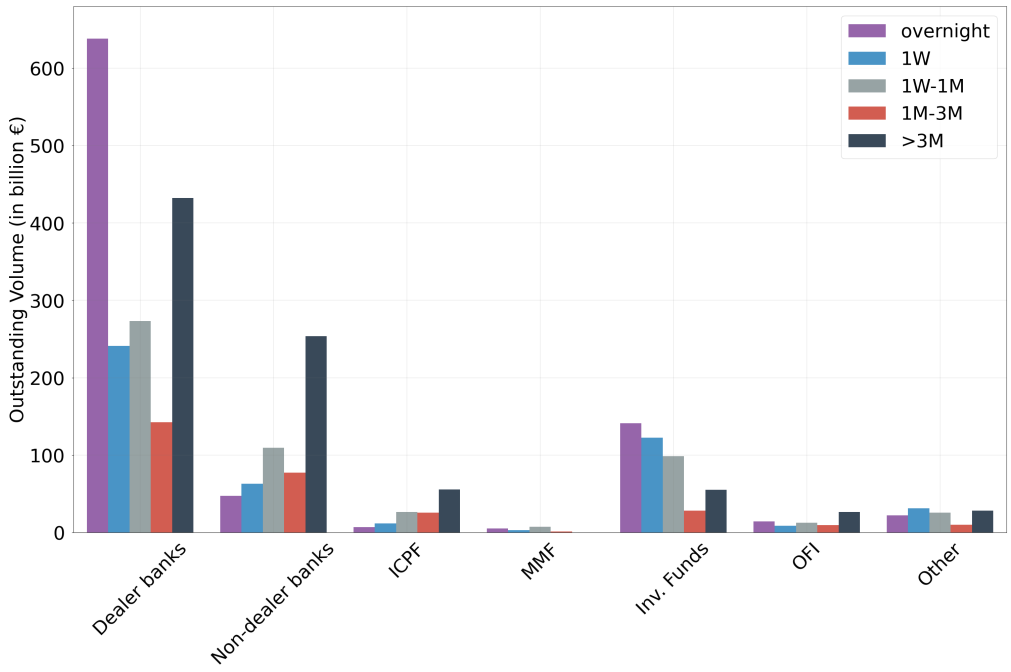
Figure E6: The maturity distribution of outstanding transactions depending on currency and clearing category



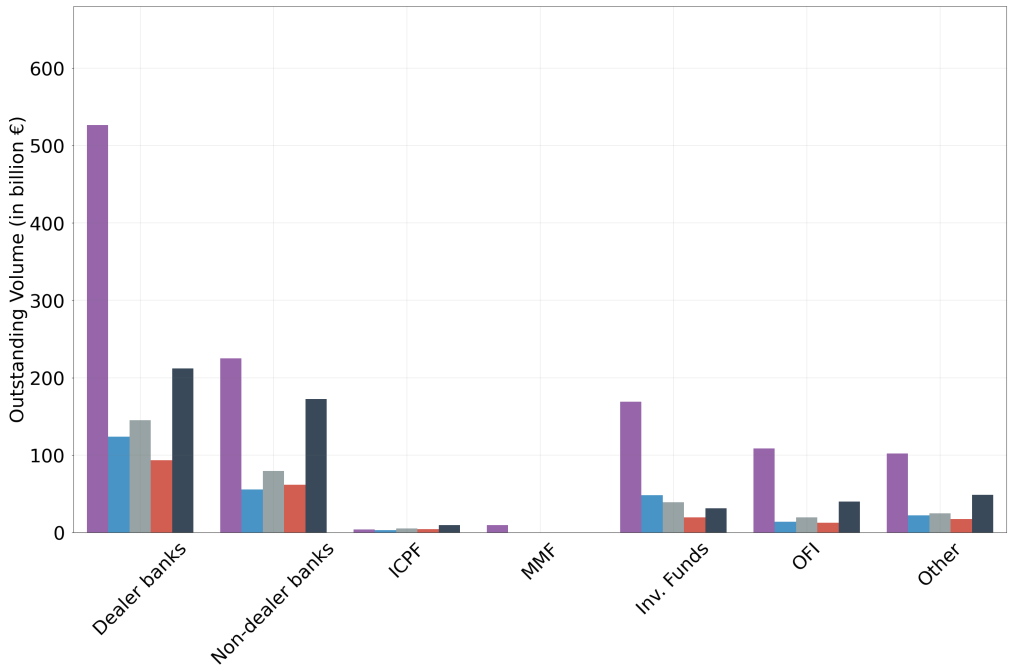
Note: The graphs show the share of each maturity bucket based on outstanding volumes. This considers only fixed repo transactions, as open repos do not have a maturity date. The buckets are overnights, up to one week, one week - one month, one month - three months, and more than three months. Sample period: 2021-01-01 – 2024-01-01

Figure E7: Outstanding gross positions based on sector and residual maturity

(a) Euro



(b) Dollar



Note: The graphs show the gross positions of different sectors in different maturity buckets. This considers only fixed repo transactions and non-centrally cleared transactions. The buckets are overnights, up to one week, one week - one month, one month - three months, and more than three months. Gross positions are defined as cash-borrowing + cash-lending. We define dealers as those banks that hold a primary dealer license as published by the European Securities and Markets Authority (ESMA). ICPF = Insurance Corporations and Pension Funds; MMF = Money Market Fund; OFI = 'Other Financial Intermediary'. Sample period: 2021-01-01 – 2024-01-01

E2. Fact 2: Maturity transformation

The results in Table E4 and E5 reveal a that it is really euro area dealer banks that engage in maturity transformation. This is in line with Figure 5a and 5b which show that dealer banks tend to borrow a lot in the overnight segment and lend via term repos. The coefficients for euro area banks in Table E5 show that for both euro-denomination (27.15) and dollar-denomination (28.09), euro area dealer banks are the entities with the strongest maturity mismatch. Table E4 also shows that almost all other sectors have a significantly lower mismatch as indicated by the negative and significant coefficients throughout the table. Notably, dealer banks who belong to a banking group that is not from the euro area, see much lower levels of maturity transformation. A caveat of this analysis is that especially in dollar-denominated transactions, we might be missing some activity of the euro area banks which might counterbalance these patterns.

Table E4: Regression Results: Euro Area vs. US and Sector Effects on Maturity Mismatch

	EUR				USD			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Euro area	14.84***		25.26***	25.36***	16.62***		24.22***	24.20***
	(0.22)		(0.70)	(0.70)	(0.32)		(0.80)	(0.80)
	non-EA nationality							
ICPF		-19.95***	-14.24***	-14.18***		-34.59***	-21.42***	-21.64***
		(0.65)	(0.73)	(0.73)		(0.69)	(0.88)	(0.88)
IF		-20.53***	-4.87***	-4.74***		-29.59***	-16.72***	-16.73***
		(0.33)	(0.61)	(0.61)		(0.41)	(0.67)	(0.67)
MMF		-16.15***	-25.60***	-25.47***		-15.37***	-1.85	-1.29
		(0.39)	(0.41)	(0.54)		(1.98)	(2.05)	(2.37)
OFI		-21.34***	-8.41***	-8.23***		-20.15***	-6.32***	-6.33***
		(0.64)	(0.87)	(0.87)		(0.52)	(0.74)	(0.74)
Other		-24.78***	-9.06***	-8.96***		-27.40***	-14.51***	-14.71***
		(0.38)	(0.64)	(0.64)		(0.46)	(0.70)	(0.70)
Non-dealer bank		-12.36***	-7.90***	-7.76***		-11.57***	0.91	0.95
		(0.45)	(1.05)	(1.05)		(0.55)	(0.78)	(0.78)
	EA nationality							
EA×ICPF			1.72	1.28			-10.73***	-9.86***
			(1.55)	(1.54)			(1.35)	(1.42)
EA×IF			-24.54***	-24.73***			-19.85***	-19.91***
			(0.73)	(0.73)			(0.86)	(0.86)
EA×OFI			-11.25***	-11.03***			-28.09***	-27.89***
			(1.49)	(1.49)			(2.01)	(2.01)
EA×Other			-23.98***	-24.01***			3.50*	3.34*
			(1.60)	(1.04)			(1.98)	(1.99)
EA×Non-dealer			-13.22***	-10.48***			-17.96***	-18.04***
			(1.72)	(1.15)			(1.27)	(1.28)
Constant	-4.27***	17.71***	1.89***	1.79***	-6.82***	17.37***	3.85***	3.89***
	(0.11)	(0.32)	(0.61)	(0.61)	(0.13)	(0.39)	(0.66)	(0.66)
Date FE	No	No	No	Yes	No	No	No	Yes
Obs.	195,583	195,583	195,583	195,583	185,224	185,224	185,224	185,224
R^2	0.03	0.03	0.05	0.05	0.02	0.04	0.05	0.05

Note: Dependent variable is maturity mismatch (days), calculated as the volume-weighted average maturity when lending cash minus the volume-weighted average maturity when borrowing cash. The estimated regression is $\text{Mismatch}_{it} = \alpha + \beta\,\text{EuroArea}_i + \sum_s \gamma_s\,\text{Sector}_i + \sum_s \delta_s(\text{EuroArea}_i \times \text{Sector}_i) + \mu_t + \varepsilon_{it}$, where EuroArea_i is a dummy equal to one if the nationality of entity i is in the euro area, Sector_i are sector dummies, and μ_t are date fixed effects (when included). The sample only includes non-cleared and non-intragroup transactions, specific collateral, and maturities up to one year. Entities are only considered on dates where they have both borrowing and lending positions in order to compute a maturity mismatch. Thus, outstanding data is being used.

Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table E5: Maturity transformation (volume-weighted lending in days - borrowing in days)

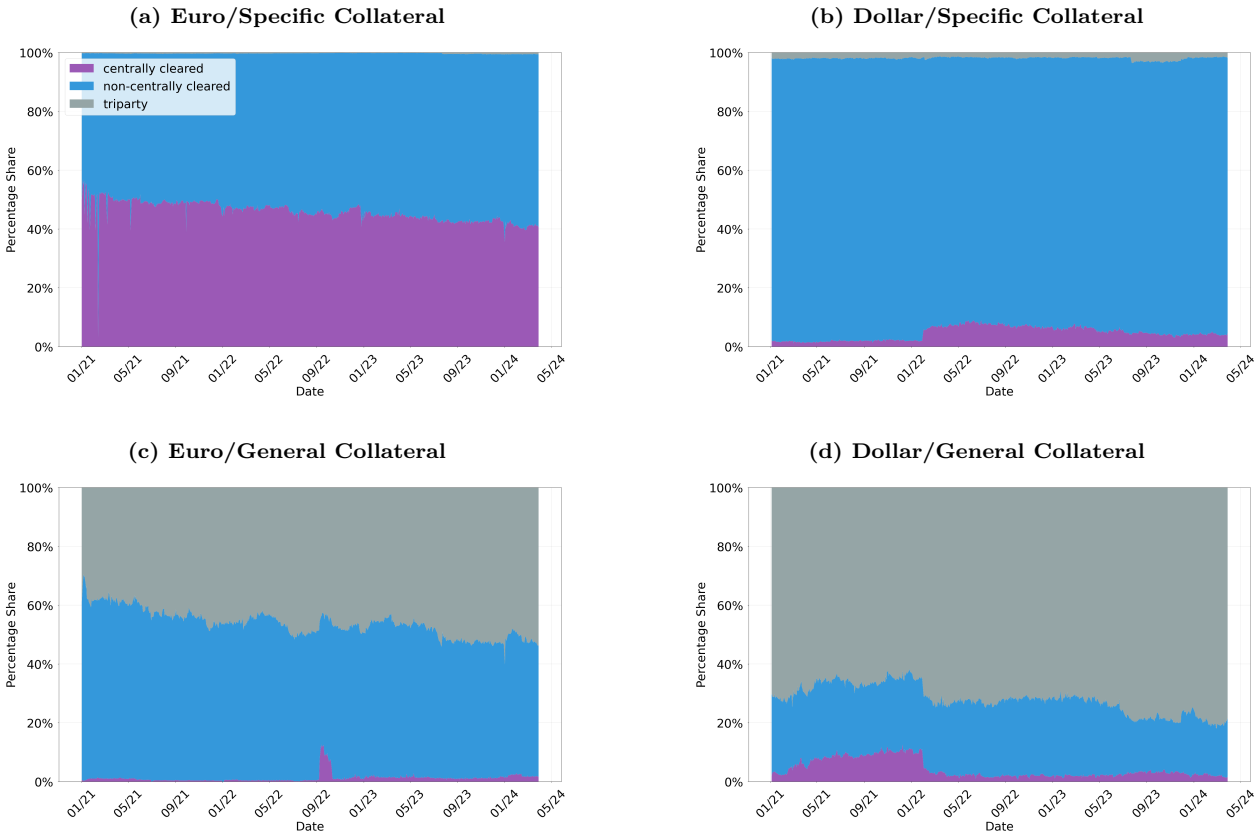
Group	EUR	Obs.	USD	Obs.
Dealer banks (non-EA)	1.79	(10,825)	3.89	(9,576)
Dealer banks (EA)	27.15	(18,134)	28.09	(12,100)
Non-dealer banks (non-EA)	-5.97	(10,127)	4.84	(34,925)
Non-dealer banks (EA)	8.91	(31,972)	11.00	(6,959)
ICPF (non-EA)	-12.39	(6,579)	-17.75	(6,748)
ICPF (EA)	14.25	(3,939)	-3.41	(180)
Inv. Fund (non-EA)	-2.95	(63,699)	-12.84	(66,529)
Inv. Fund (EA)	-2.32	(17,667)	-8.55	(11,634)
OFI (non-EA)	-6.44	(7,939)	-2.44	(12,599)
OFI (EA)	7.89	(2,062)	-6.13	(1,101)
Other (non-EA)	-7.17	(20,631)	-10.82	(22,340)
Other (EA)	-5.82	(1,758)	16.72	(517)

Note: Combined coefficients are computed as constant + relevant sector dummy + euro dummy + interaction. MMFs are excluded because they featured too few observations.

F. Fact 3

F1. The clearing distribution by motive of the transaction

Figure F8: The clearing distribution of outstanding transactions depending on currency and collateral type



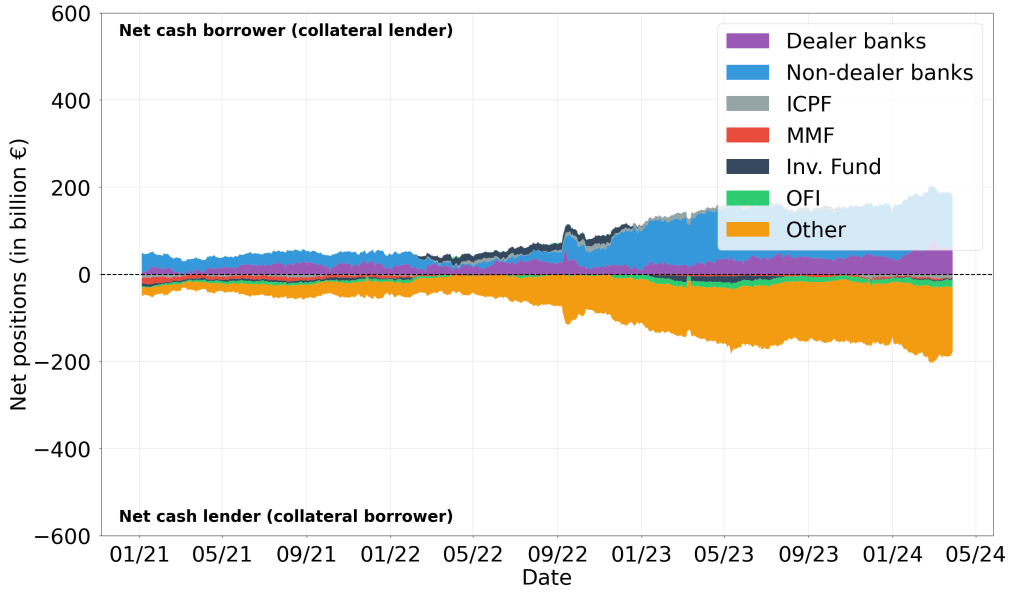
Sample period: 2021-01-01 – 2024-04-01

Figure F8 shows the clearing distribution of outstanding transactions depending on currency and collateral type. Central clearing predominantly handles specific collateral trades in both currencies, reflecting its efficiency in processing standardized transactions, whereas non-central clearing is present in both collateral- and cash-driven transactions. In contrast, triparty clearing is used almost exclusively in cash-driven transactions, and this is much more pronounced in the case of dollar transactions. This is in line with the literature on the USD repo market that argues that the triparty market is a funding market (D'Amico, Fan, and Kitsul, 2018; Baklanova, Caglio, Cipriani, and Copeland, 2019).

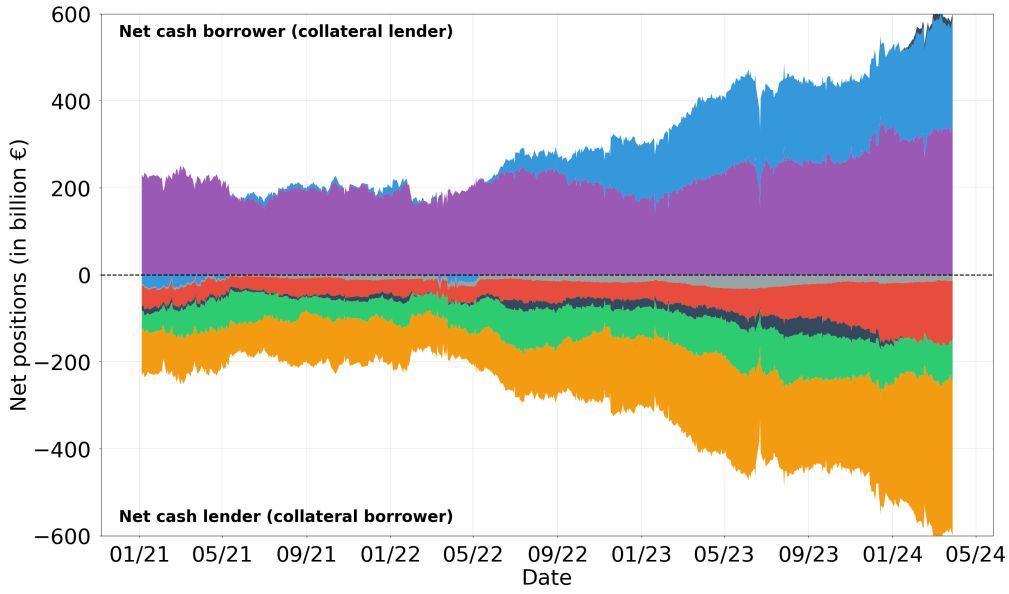
F2. Cash-driven transactions by sector

Figure F9: Outstanding net positions in transactions with general collateral by sector

(a) Euro



(b) Dollar



Note: The graphs show outstanding net positions in euro-denominated transactions. Net positions are calculated as cash borrowing volume - cash lending volume. (a) shows net positions in cash-driven transactions by sectors. A positive value indicates that this sector type is a net borrower of USD. (b) shows net positions in collateral-driven transactions by sectors. A positive value indicates that this sector type is a net provider of collateral. Sample period: 2021-01-01 – 2024-01-01

Figure F9a shows the outstanding net positions in cash-driven transactions by sector. It illustrates that in euro-denominated transactions, non-dealer banks emerge as the primary net cash borrowers. In contrast, the 'Other' sector (comprising entities such as governments, central counterparties (CCPs), and international organizations) represents the main net cash lenders.[27] The pattern differs somewhat for dollar-denominated cash-driven transactions (Figure F9b). Here, dealer banks stand out as the dominant net cash borrowers, likely reflecting their function in intermediating US dollar liquidity across the euro area. Notably, non-dealers have recently increased their net borrowing positions in US dollars, suggesting an evolving role in dollar funding markets. Moreover, cash-driven transactions in euro denomination are much more balanced compared to dollar denomination. This likely reflects our earlier intuition on the structural demand for US dollars as opposed to euros. These results provide a different perspective to repo market studies such as Krishnamurthy, Nagel, and Orlov (2014) who show that money market funds (MMFs) are key sources of funding in the repo market. MMFs are key to providing cash in the triparty repo market, but less so in non-centrally cleared transactions. Since our dollar market segment relates mainly to non-centrally cleared transactions, MMFs are less relevant.

[27] These entities, despite not always having a reporting obligation, appear in the data due to their role as counterparties to institutions that are subject to reporting requirements.

G. Fact 4

G1. Intragroup flows in shares

Table G6: The share of outstanding intragroup transactions by jurisdiction pairs

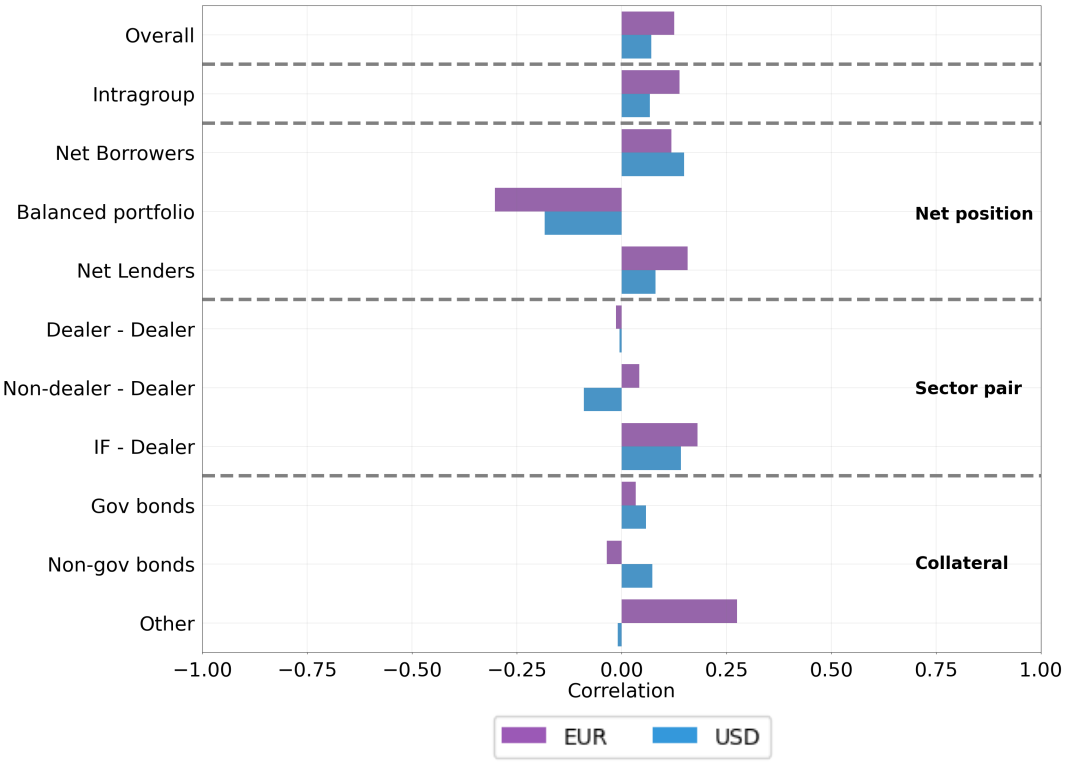
	EUR	USD
Intragroup share	36.48%	25.11%
EA to EA	27.89%	6.09%
EA to GB	33.53%	6.10%
GB to EA	35.78%	8.77%
EA to US	0.20%	7.19%
US to EA	0.34%	6.85%
US to GB	0.00%	28.82%
GB to US	0.00%	15.64%
GB to GB	0.03%	0.10%
US to US	0.00%	14.92%

Note: The intragroup share refers to the overall share of non-centrally cleared transactions that are intragroups for the respective currency. The shares refer exclusively to intragroup transactions. They show which jurisdiction lends (left) and borrows (right) cash via intragroups for the respective currencies. This is based on the residence view, thus it shows the actual flow of money. The numbers do not add to 100% because the table only shows the major jurisdiction pairs. Sample period: 2021-01-01 – 2024-04-01

H. Fact 5

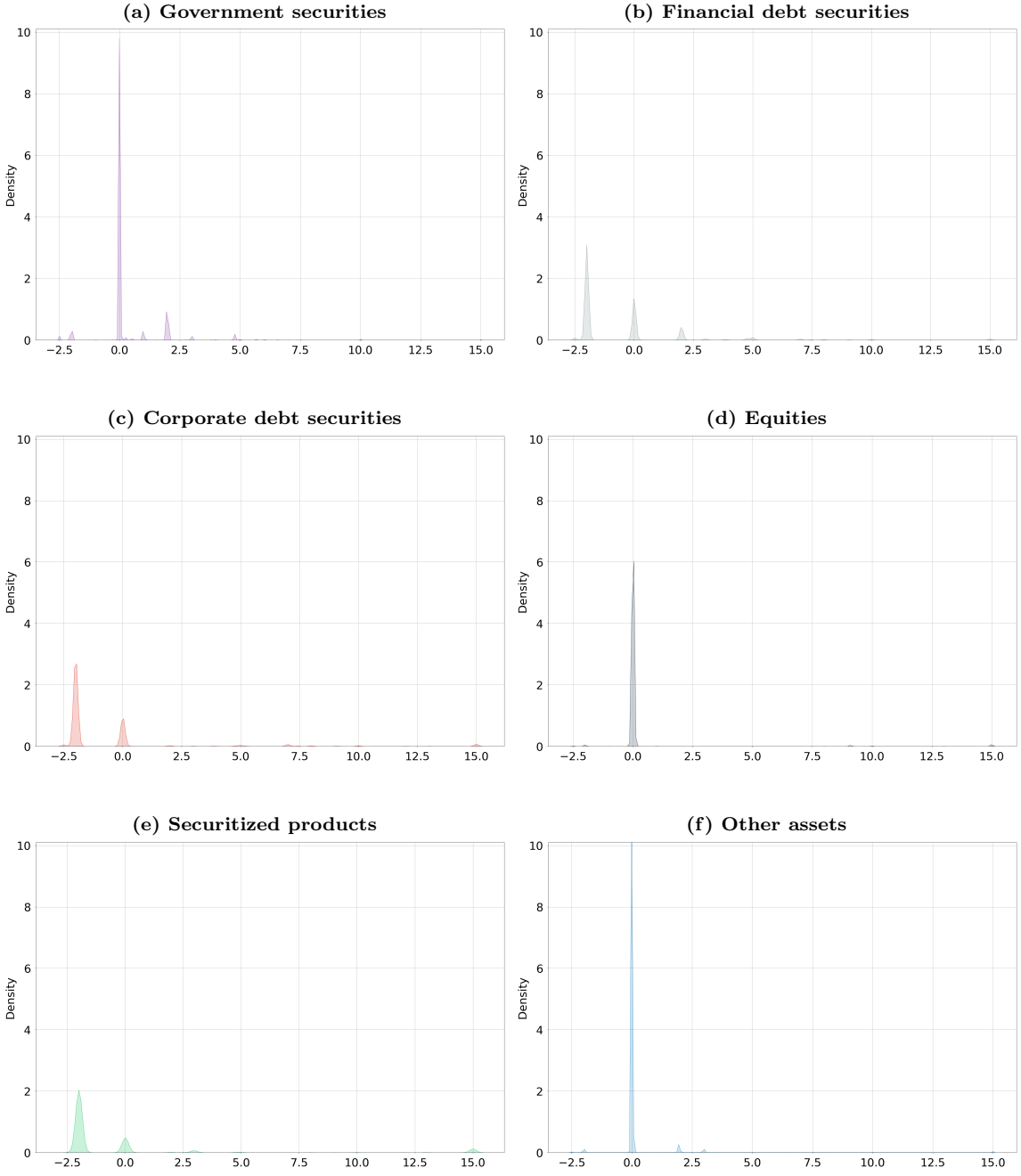
H1. Haircuts and repo rates

Figure H10: The correlation of haircuts and repo rates in the cross section



Note: This chart shows the correlation between repo rates and haircuts. It considers non-cleared transactions with a maturity of one day and government securities underlying (unless for the last group). The first bar shows the correlation across all transactions. The second bar shows the correlation in intragroup transactions. The following groups exclude intragroup transactions. The third set of bars ("Net position") groups entities into net cash-borrowers (collateral providers), net cash-lenders (collateral takers), and those entities that have a balanced portfolio. Net borrowers (lenders) are those entities whose cash borrowing (lending) volume accounts for more than 65% of their total volume. The fourth set of bars ("Sector pair") considers counterparty pairs where the left label refers to the cash-lender (collateral taker) and the right label to the cash-borrower (collateral provider). The fifth set of bars ("Collateral") shows the correlation for different collateral types. Sample period: 2021-01-01 – 2024-01-01

H2. Additional information on haircuts



Sample period: 2021-01-01 – 2024-01-01

I. Application 2

Table I7: Independent variables for the negative haircut analysis

Variable	Definition
Dependent Variable	
Negative Haircut	Binary indicator equal to one if the haircut in a repo transaction is negative, and zero otherwise
General	
EUR	Binary indicator equal to one if the transaction is denominated in euros, and zero otherwise
Intragroup	Binary indicator equal to one if the transaction is between entities belonging to the same banking group, and zero otherwise
Dealer borrower	Binary indicator equal to one if the cash borrowing entity is a dealer, and zero if it is a non-dealer bank or not a bank at all.
Non-dealer borrower	Binary indicator equal to one if the cash borrowing entity is a non-dealer bank, and zero if it is a dealer bank or not a bank at all.
Collateral Categories	
Corporate	Binary indicator equal to one if the underlying collateral is a corporate debt security (i.e. a corporate bond), and zero otherwise
Financial	Binary indicator equal to one if the underlying collateral is a financial debt security (i.e. a bank bond), and zero otherwise
Equities	Binary indicator equal to one if the underlying collateral consists of equity securities, and zero otherwise
Other	Binary indicator equal to one if the underlying collateral consists of other securities not captured by other categories, and zero otherwise
Securitized	Binary indicator equal to one if the underlying collateral consists of securitized products, and zero otherwise
Government	Binary indicator equal to one if the underlying collateral consists of government securities, and zero otherwise
Maturity Categories	
Overnight	Binary indicator equal to one if the repo maturity is one day, and zero otherwise
Maturity 1W	Binary indicator equal to one if the repo maturity is up to one week (excluding overnight), and zero otherwise
Maturity 1M	Binary indicator equal to one if the repo maturity is between one week and one month, and zero otherwise
Maturity 3M	Binary indicator equal to one if the repo maturity is between one month and three months, and zero otherwise
Long term	Binary indicator equal to one if the repo maturity exceeds three months, and zero otherwise
Open term	Binary indicator equal to one if the repo has no fixed maturity date, and zero otherwise
Control Variables	
Transaction size	Natural logarithm of the cash amount in the repo transaction, z-score normalized
Repo rate	Interest rate applied to the repo transaction, in percent
Cleared	Binary indicator equal to one if the transaction is centrally cleared, and zero otherwise
General Collateral	Binary indicator equal to one if the transaction uses general collateral rather than specific collateral, and zero otherwise
Net exposure	Binary indicator equal to one if the collateral has been provided for a net exposure, rather than for a single transaction.
Fixed Effects	
Time FE	Monthly time fixed effect
Security × Intra FE	Fixed effects for the interaction between collateral category and intragroup status
Maturity × Intra FE	Fixed effects for the interaction between maturity categories and intragroup status

Note: This table provides definitions for all variables used in the logit regression analysis.

I1. Application 2: Logit regression results for the drivers of negative haircuts

On the following pages, the logit regressions underlying the results in Section 3.5 are presented. Furthermore, the results regarding maturities are discussed.

Table I8: Logit regression results for the determinants of negative haircuts – Baseline effects

	EUR					USD				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
Intragroup	3.14**					3.18**				
	(0.96)					(1.15)				
Dealer borrower		4.44***					3.94***			
		(1.02)					(1.25)			
Non-dealer borrower		1.61					1.00			
		(1.04)					(0.80)			
Specialness			1.65***					2.84**		
			(0.21)					(1.20)		
Corporate				3.64***					0.26	
				(0.51)					(0.52)	
Financial				2.60***					1.52***	
				(0.50)					(0.30)	
Equities				2.39***					-3.88***	
				(0.68)					(1.40)	
Other				0.71					-2.64***	
				(0.51)					(0.76)	
Securitized				4.61***					-2.84***	
				(0.76)					(1.06)	
Maturity 1W					-2.14***					0.26
					(0.65)					(0.50)
Maturity 1M					-2.66***					0.11
					(0.93)					(0.96)
Maturity 3M					-2.76***					0.31
					(0.95)					(1.01)
Long term					-3.61***					0.27
					(0.94)					(1.03)
Open term					-3.47***					0.23
					(1.08)					(1.12)
Obs.	3,625,678	3,625,678	3,625,678	3,625,678	3,625,678	2,912,376	2,912,376	2,912,376	2,912,376	2,912,376
Pseudo R^2	0.15	0.10	0.10	0.30	0.09	0.22	0.25	0.10	0.17	0.00

Note: The regression is based on flow data. End-of-month reporting dates have been excluded to avoid picking up window-dressing behavior. The reference category for collateral types is government securities, whereas for maturities it is overnights. Specialness is defined as a transaction with a repo rate of 10 or more basis points below the deposit facility rate (in the respective currency). All specifications control for transaction size and are restricted to non-centrally cleared transactions with specific collateral, where collateral has been posted for a single transaction rather than for net exposure. Standard errors are clustered by month and counterparty-pair and reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Sample period: 2021-01-01 – 2024-04-01.

Table I9: Logit regression results for the determinants of negative haircuts — Intragroup interaction

	EUR			USD		
	(6)	(7)	(8)	(6)	(7)	(8)
Intragroup	-1.22	1.69**	3.63***	2.63*	2.43**	4.28***
	(0.98)	(0.85)	(1.11)	(1.10)	(1.08)	(1.29)
Dealer borrower	2.11***			2.50***		
	(0.60)			(0.82)		
Non-dealer borrower	-0.54			0.87		
	(0.71)			(0.85)		
Corporate		0.50			0.84*	
		(0.72)			(0.46)	
Financial		-0.07			1.26***	
		(0.42)			(0.45)	
Equities		1.10			-3.15***	
		(0.82)			(1.09)	
Other		-2.01***			-1.63**	
		(0.33)			(0.81)	
Securitized		-1.45***			-1.25*	
		(0.51)			(0.67)	
Maturity 1W			0.72			2.44***
			(0.57)			(0.57)
Maturity 1M			0.74			2.80***
			(0.57)			(0.69)
Maturity 3M			0.64			3.02***
			(0.59)			(0.73)
Long term			-0.20			2.83***
			(0.58)			(0.71)
Open term			-0.10			2.12***
			(0.80)			(0.72)
Dealer × Intra	3.68***			-0.50		
	(1.40)			(1.59)		
Non-dealer × Intra	4.95***			-1.61		
	(1.52)			(1.23)		
Intra × Corporate		3.91***			0.06	
		(1.06)			(0.93)	
Intra × Equities		2.95***			2.79*	
		(1.14)			(1.66)	
Intra × Financial		2.80***			0.21	
		(0.71)			(0.72)	
Intra × Other		2.77***			0.03	
		(0.60)			(0.98)	
Intra × Securitized		7.36***			-11.34***	
		(1.19)			(1.20)	
Intra × 1W			-2.21**			-2.73***
			(0.92)			(0.63)
Intra × 1M			-3.67***			-4.14***
			(1.39)			(1.30)
Intra × 3M			-3.64***			-4.56***
			(1.32)			(1.31)
Intra × Long term			-3.72***			-3.60**
			(1.28)			(1.51)
Intra × Open term			-3.24**			-1.39
			(1.38)			(1.61)
Obs.	3,625,678	3,625,678	3,625,678	2,912,376	2,912,376	2,912,376
Pseudo R^2	0.17	0.42	0.17	0.31	0.29	0.26

Note: The regression is based on flow data. End-of-month reporting dates have been excluded to avoid picking up window-dressing behavior. The reference category for collateral types is government securities, whereas for maturities it is overnights. Specialness is defined as a transaction with a repo rate of 10 or more basis points below the deposit facility rate (in the respective currency). All specifications control for transaction size and are restricted to non-centrally cleared transactions with specific collateral, where collateral has been posted for a single transaction rather than for net exposure. Standard errors are clustered by month and counterparty-pair and reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Sample period: 2021-01-01 – 2024-04-01.

Table I10: Logit regression results for the determinants of negative haircuts — Specialness interaction

	EUR			USD		
	(9)	(10)	(11)	(9)	(10)	(11)
Specialness	1.30	1.42***	1.71***	0.99	2.68**	6.19***
	(0.90)	(0.13)	(0.27)	(0.99)	(0.91)	(1.34)
Dealer borrower	3.94***			-0.75		
	(1.10)			(1.12)		
Non-dealer borrower	1.26			2.03*		
	(0.87)			(1.12)		
Corporate		3.95***			1.19*	
		(0.59)			(0.50)	
Financial		1.94***			2.00***	
		(0.55)			(0.56)	
Equities		1.66***			-3.16**	
		(0.62)			(1.16)	
Other		-0.40**			-0.83	
		(0.16)			(1.19)	
Securitized		3.76***			0.18	
		(0.72)			(0.72)	
Maturity 1W			-2.20***			4.59***
			(0.68)			(0.53)
Maturity 1M			-2.43**			5.43***
			(1.03)			(0.89)
Maturity 3M			-3.00***			5.95***
			(1.03)			(0.92)
Long term			-3.53***			5.53***
			(1.00)			(0.90)
Open term			-2.27**			4.68***
			(1.15)			(0.93)
Specialness × Dealer	0.29			4.24**		
	(0.94)			(1.42)		
Specialness × Non-dealer	-0.03			-1.91		
	(1.02)			(1.22)		
Specialness × Corporate		-0.49*			-0.06	
		(0.27)			(0.57)	
Specialness × Equities		1.58**			3.39**	
		(0.69)			(1.27)	
Specialness × Financial		1.10**			0.22	
		(0.47)			(0.60)	
Specialness × Other		1.27**			-1.38	
		(0.58)			(1.16)	
Specialness × Securitized		3.13***			-5.19***	
		(0.33)			(1.05)	
Specialness × 1W			-0.07			-4.68***
			(0.30)			(0.69)
Specialness × 1M			-0.37			-5.84***
			(0.44)			(1.29)
Specialness × 3M			0.23			-6.51***
			(0.48)			(1.33)
Specialness × Long term			-0.02			-5.70***
			(0.46)			(1.43)
Specialness × Open term			-1.80***			-4.98***
			(0.45)			(1.52)
Obs.	3,625,678	3,625,678	3,625,678	2,912,376	2,912,376	2,912,376
Pseudo R^2	0.18	0.38	0.18	0.29	0.23	0.12

Note: The regression is based on flow data. End-of-month reporting dates have been excluded to avoid picking up window-dressing behavior. The reference category for collateral types is government securities, whereas for maturities it is overnights. Specialness is defined as a transaction with a repo rate of 10 or more basis points below the deposit facility rate (in the respective currency). All specifications control for transaction size and are restricted to non-centrally cleared transactions with specific collateral, where collateral has been posted for a single transaction rather than for net exposure. Standard errors are clustered by month and counterparty-pair and reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Sample period: 2021-01-01 – 2024-04-01.

Table I11: The difference in maturity distribution between all transactions, only intragroup transactions, and intragroup transactions with a negative haircut based on outstanding volumes

	EUR			USD		
Maturity bucket	all	intragroup	haircut	all	intragroup	haircut
overnight	21.93%	44.61%	88.12%	40.80%	49.68%	43.46%
one week	7.90%	3.17%	1.71%	6.92%	3.91%	5.55%
one month	22.77%	11.71%	2.37%	13.60%	10.09%	3.01%
three month	13.21%	8.36%	1.26%	11.35%	6.62%	1.30%
>three month	18.42%	16.58%	3.98%	9.68%	1.97%	0.13%
open term	15.77%	15.56%	2.56%	17.66%	27.73%	46.56%

Note: The shares are based on non-centrally cleared transactions. The 'all' columns show the maturity distribution overall for the respective currency, whereas the intragroup columns show the distribution for the subset of intragroup transactions, and the haircut columns show the subset of intragroup transactions with negative haircuts. Sample period: 2021-01-01 – 2024-04-01

In addition to the intragroup transactions, bank borrowing, and collateral demand, we consider the maturity of the transaction in driving negative haircuts. Standard risk management would suggest that haircuts should be increasing in maturity because longer time horizons give more room for unexpected movements in collateral values. Consequently, overnights should be associated with the lowest haircuts and therefore might be most prone to be negative. To test this hypothesis, we include maturity bucket dummies in specification (5), using overnight transactions as the reference category.

For euro transactions, the negative and significant coefficients in Table I8 and Table I10 for all maturity buckets indeed indicate that overnights are the most likely to have negative haircuts (log odds of -2.14 to -3.61, or odds ratios of 0.11 to 0.03). However, this finding primarily reflects the concentration of intragroup transactions in overnight maturities.[28] Thus, when we account for this pattern by including maturity-intragroup interaction terms in specification (8) in Table I9, the significance disappears. In dollar transactions (Table I8), specification (5) shows that the other maturity buckets do not differ significantly from overnight transactions in their likelihood for negative haircuts; in fact, signs even tend to be positive. When accounting for intragroup transactions (Table I9), all maturity buckets have positive and significant coefficients (log odds of 2.12 to 3.02, or odds ratios of 8.33 to 20.50). Thus, when a transaction is not associated with an intragroup transactions, overnight USD

[28]Statistics on this can be found in the Appendix Table I11

transactions are less likely than term repos to feature a negative haircut. This again underscores the fact that intragroup transactions are important in explaining negative haircuts. A possible rationale for why longer-term transactions are more likely to have negative haircuts when we account for intragroup transactions might again relate to bargaining power. The bargaining power between cash borrowers and lenders becomes more important in longer-term transactions since both parties are committed to a longer relationship. When a borrower has specific collateral that a lender wants for an extended period (e.g., for long-term short positions or regulatory requirements), the borrower has stronger negotiating power. The lender may be willing to accept a negative haircut to secure this collateral for a longer duration. The same pattern holds when accounting for specialness (Table I10). The coefficients are all positive and significant (log odds 4.59–5.95, corresponding to odds ratios 98.6–384.0), indicating that when the collateral is not on special, longer-term dollar repos are more likely to feature negative haircuts. This contrasts with euro-denominated repos, where longer maturities are less likely to exhibit negative haircuts in the absence of specialness, consistent with funding-driven motives. The reversal for dollar repos likely reflects the fact that all transactions involve euro-area entities. Thus, when dollars are scarce and Treasuries are not on special, cash lenders hold the bargaining power, particularly at short maturities where euro-area borrowers have few alternative funding sources. Conversely, when Treasuries are on special, bargaining power shifts to collateral providers and leading to negative haircuts, especially in overnight trades.