Journal Pre-proof

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PII: S1572-3089(24)00032-9
DOI: https://doi.org/10.1016/j.jfs.2024.101247
Reference: JFS 101247

To appear in: *Journal of Financial Stability*

Received date : 19 May 2022
Revised date : 1 December 2022
Accepted date : 16 February 2024

Please cite this article as: M. Bellia, G. Girardi, R. Panzica et al., The demand for central clearing: To clear or not to clear, that is the question!. *Journal of Financial Stability* (2024), doi: https://doi.org/10.1016/j.jfs.2024.101247.

The Demand for Central Clearing: To Clear or Not to Clear, That is the Question!

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Abstract

This paper empirically analyses whether post-global financial crisis regulatory reforms have created appropriate incentives to voluntarily centrally clear over-the-counter (OTC) derivative contracts. We use confidential European trade repository data on single-name sovereign credit default swap (CDS) transactions and show that both seller and buyer manage counterparty exposures and capital costs, strategically choosing to clear when the counterparty is riskier. The clearing incentives seem particularly responsive to seller credit risk, which is in line with the notion that counterparty credit risk (CCR) is

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asymmetric in CDS contracts. The riskiness of the underlying reference entity also impacts the decision to clear as it affects both CCR capital charges for OTC contracts and central counterparty clearing house (CCP) margins for cleared contracts. Lastly, we find evidence that when a transaction helps netting positions with the CCP and hence lower margins, the likelihood of clearing is higher.

Keywords: Credit Default Swap (CDS), Central Counterparty Clearing House (CCP), European Market Infrastructure Regulation (EMIR), Sovereign CDS
JEL Classification: G18, G28, G32.

Acknowledgement

We thank the editor and the two anonymous referees for providing constructive feedback to improve our manuscript. We are grateful to Roberto Stok and Marco D'Errico for their very helpful comments as well as IT and data support. We also thank the ESRB CCP Task Force for their useful comments, particularly Pietro Stecconi and Daniela Russo. Loriana Pelizzon thanks the Leibniz Institute for Financial Research SAFE for financial support. Part of this work was carried out when Mario Bellia and Roberto Panzica were research visitors at the ESRB Secretariat.

1. Introduction

The global financial crisis exposed a number of systemic weaknesses in the market for over-the-counter (OTC) derivative securities. In response, the G20 leaders in 2009 initiated a fundamental overhaul of OTC derivatives markets to mitigate systemic risk, improve transparency, and protect against market abuse. The G20 leaders made five commitments to reform OTC derivatives markets: 1) standardized OTC derivatives should be centrally cleared, 2) non-centrally cleared derivatives should be subject to higher capital requirements, 3) non-centrally cleared derivatives should be subject to minimum standards for margin requirements, 4) OTC derivatives should be reported to trade repositories (TRs), and 5) standardized OTC derivatives should be traded on exchanges or electronic trading platforms, where appropriate.[1]

In both Europe and the United States, while CDS indices must be cleared under the MiFID and Exchange Act regulations, respectively, [2] a rule for single-name CDS reference entities has not yet been finalized, and clearance of single-name CDS contracts is voluntary. The Bank for International Settlements (BIS) reports[3] indicate that the share of cleared derivatives contracts continues to be a relatively small fraction of the total notional amount outstanding (around 37% as reported by Financial Stability Board (2017)), though this proportion is increasing over time.

This empirical evidence indicates that, since the decision to clear single-name CDS is voluntary, not all transactions are cleared; this offers an ideal laboratory for evaluating regulatory policies and incentives of market participants to clear or not clear a single-name CDS transaction.

This paper investigates why only some sovereign CDS transactions currently eligible for central clearing are cleared while others are not. We study this research question from a clearing member perspective and focus on what drives this decision by considering factors impacting capital and collateral costs.[4] Analyzing the drivers of the decision to clear contracts eligible but not mandated to be cleared matters for evaluating policies related to clearing obligations and for understanding which institutions would be most affected by further obligations to centrally clear. Furthermore, despite the clearing mandate for certain types of derivatives, the actual decision to clear is always partly subject to the discretion of a trade's counterparties because they

[1]The US Congress passed the Dodd-Frank Wall Street Reform and Consumer Protection Act (DFA) into law in 2010, and the European Parliament and the Council of Ministers agreed on the European Market Infrastructure Regulation (EMIR) in 2012. See the Financial Stability Board (FSB) report to G20 Leaders on progress in financial regulatory reforms, available at http://www.fsb.org/2017/07/fsb-reports-to-g20-leaders-on-progress-in-financial-regulatory-reforms/.

[2]The Markets in Financial Instruments Directive 2004/39/EC and Exchange Act Section 3C(b)(4)(B).

[3]See the BIS OTC derivatives statistics database, available at https://stats.bis.org/statx/srs/table/d10.4

[4]Capital costs represent the incremental costs a firm incurs to finance more of its assets with equity (as a consequence of the incremental regulatory capital requirements) rather than with debt. Collateral costs, meanwhile, reflect the incremental costs of borrowing cash to acquire eligible collateral. In a theoretical model calibrated with Depository Trust & Clearing Corporation (DTCC) data, Duffie et al. (2015) find that collateral demand does not increase with mandatory central clearing.

could customize a given contract to circumvent clearing obligations. This underlines the importance of empirical work on the determinants of voluntary clearing to help regulators align the incentives around clearing obligations appropriately (Financial Stability Board, 2018).

We empirically analyze the relevance of these different drivers in the decision to clear by using a unique regulatory dataset: the confidential European TR data on single-name sovereign CDS transactions regulated by the EMIR. The database used for our analysis consists of CDS traded in 2016 in which at least one of the two counterparties was an EU financial institution. Our analysis focuses on the most traded European sovereign CDS contracts: Italy (IT), France (FR), and Germany (DE). We examine only these three sovereign CDS because of data availability. They are among the contracts most frequently traded by European institutions and therefore well represented in our database (see Abad et al., 2016) and reflect marked differences in underlying reference entity risk.

To our knowledge, ours is the first paper to empirically investigate the fraction of eligible CDS contracts for clearing and the drivers of the decision to clear a contract.[5] We find that in our sample about 48% of the notional amount traded in 2016 was cleared, 42% was not cleared despite being eligible for central clearing, and 9% was not clearable because the contracts did not satisfy central counterparty clearinghouse (CCP) clearing criteria.

In our data, we notice a stark difference in the decision to clear between clearing members and non-clearing members. Clearing members account

[5]The two studies most closely related to ours are Cenedese et al. (2020) and Fiedor (2018). The first paper analyzes the heterogeneity in interest rate swaps (IRS) pricing among UK market participants. While our work focuses on the drivers of the decision to clear in the inter-dealer CDS market in light of the tradeoffs between capital and margin costs of EU clearing members, Cenedese et al. (2020) exclude the inter-dealer segment to focus on the drivers of IRS OTC premia among UK dealers and clients, while only tangentially investigating their clearing decisions. Moreover, the current regulatory clearing regime of the two markets is different. While the vast majority of the IRS market is currently subject to mandatory clearing, no rule for mandatory clearing of single-name CDS has yet been finalized. An interesting analysis of the main distinguishing characteristics of the contracts and counterparties associated with central clearing is provided by Fiedor (2018). While our work analyzes the drivers of the decision to clear *only* for transactions that meet all the requirements for central clearing, Fiedor (2018) looks at the system-wide level without delving deeply into the clearing requirements of the different derivatives markets object in their analysis.

for 96.5% of the gross notional amount traded and are net buyers of an aggregate of \$9.7 billion, an amount comparable to the net selling position of non-clearing members that are not subject to capital requirements (-\$8.1 billion). For clearing members, we find that the fraction of cleared contracts is 53%, while the fraction of contracts non-eligible for clearing is 8%. For non-clearing members (both those subject to capital requirements – banks and insurers – and those that are not), we observe that the fraction of clearing activity is close to zero.[6]

We model the clearing members' incentives[7] to clear a contract based on the (i) riskiness of the counterparty, (ii) characteristics of the contract that affect both the CCP margins and capital requirements related to CCR, and (iii) clearing member's net exposure vis-à-vis the CCP.[8]

In principle, riskier contracts could encourage clearing in order to reduce CCR capital requirements; however, riskier contracts can entail larger margins and clearing costs with the CCP. We investigate this issue empirically to

[6]This fraction is likely to be a lower bound of the true amount of clearing activity of non-clearing members due to the fact that a portion of their trades cleared through omnibus client accounts may be attributed in our dataset to the clearing members instead of their clients.

[7]The model offered by Ghamami and Glasserman (2017) identifies three main drivers from the dealer's perspective to centrally clear a transaction when there is no clearing obligation. The first is the netting efficiency across asset classes, the second is the margin period of risk (i.e., the time between the counterparty's default and the closing of the position), and the third is the size of the clearing member's contribution to the default fund. While the first driver is largely related to the decision to centrally clear a transaction, the other two have more to do with the decision to become a clearing member. Our paper primarily provides evidence of the relevance of the first main driver.

[8]Duffie and Zhu (2011) provide a framework where the introduction of clearing for a single asset class, like CDS, could limit netting efficiencies, thus increasing collateral demand and counterparty exposures at the same time. With a different parameterization of the model and different assumptions, Cont and Kokholm (2014) find that multi-asset class central clearing reduces inter-dealer exposures, but a single non-specialized clearing house can pose systemic risk issues. Kubitza et al. (2023) show that considering systematic risk reduces the number of instances when multilateral netting (and therefore clearing) dominates bilateral netting. In their theoretical model, Acharya and Bisin (2014) show that central clearing limits excess risk-taking by counterparties because of greater transparency and margin requirements, Koeppl et al. (2012) show that central clearing and an optimal margin design mitigate the moral hazard of excessive risk-taking and reduce counterparty risk, and Zawadowski (2013) shows that welfare improves when OTC contracts are taxed to finance a bailout fund.

understand which element prevails. An important aspect to consider when modeling the decision to clear relates to the individual incentives each firm faces vis-à-vis its outstanding exposures with both the CCP and the counterparty of the trade. In principle, trades that reduce outstanding CCP exposures should be more likely to be cleared as they help reduce CCP margin requirements. Similarly, trades that reduce outstanding bilateral exposures with the counterparty of the contract should be more likely to be kept OTC, as they allow flattening the books and thus reducing capital charges. Incentives between the two counterparties may not always be aligned; in addition, buyer and seller may have different negotiating power. Despite some data constraints, we model these types of incentives by studying how net outstanding exposures with the CCP influence the decision to clear, separately for the buyer and seller of a contract.[9]

When investigating how the credit risk of the counterparty impacts the decision to clear, we find that both the buyer and the seller of a contract manage the counterparty's exposures, strategically choosing to clear when the other counterparty is riskier. The decision to clear appears to be particularly closely tied to the seller's credit risk, providing evidence of the asymmetry in CCR that is intrinsic to CDS contracts.[10] These results suggest that benefits in the reduction of CCR exposures and capital requirements provide relevant incentives for clearing members to clearing CCP eligible trades.

When analyzing how a contract's characteristics impact the decision to clear, we find significant differences among the three sovereign CDS considered in our analysis. In general, we find evidence that the riskiness of the reference entity, as measured by the level of the CDS spread, is positively related to the probability to clear. However, while we find some evidence that daily increases in the CDS spread or CDS spread volatility increase the likelihood of central clearing for Italian sovereign CDS, the reverse is true for German and French sovereign CDS. Furthermore, we find that the size of

[9]Our dataset does not allow us to reconstruct US clearing members' outstanding positions vis-à-vis the CCP. Hence, we analyze how outstanding exposures with the CCP affect the decision to clear exclusively for European buyers and sellers of a contract.

[10]When buying protection, the maximum loss the CDS buyer may incur is theoretically equal to 100% of the notional CDS value, which would occur in the event of a double default of the CDS seller and the reference entity and a zero recovery rate. When selling protection, by contrast, the maximum loss to the CDS seller is limited to the present value of the remaining CDS premium payments.

contract is positively related to the probability to clear, indicating that for larger trades CCR factors may prevail over possible post-trade transparency concerns.[11]

Consistent with the notion that clearing members face incentives to flatten their outstanding net positions with the CCP to reduce margin requirements, we find that the likelihood to clear the contract is higher for trades that reduce a clearing member's outstanding position with the CCP. Taken together, our findings indicate that while the main drivers of the decision to clear for Italian CDS may be CCR capital requirements, while for France and Germany margin cost considerations may prevail. Overall, we find that the decision to clear is complex; it is not related only to a single contract but also to portfolio holdings and total exposures with CCPs, along with the incentives the buyer and seller face to reduce counterparty risk and capital requirements.[12]

This paper is organized as follows. In Section 2 we provide a detailed description of the institutional setting that characterizes a typical transaction, including the incentives and tradeoffs involved in a centrally cleared transaction. This evidence leads us to the formulation of the hypotheses tested in the paper, which we discuss in Section 3. In Section 4 we provide an overview of our data sample and define the variables used in the analysis. We report the empirical evidence regarding the decision to clear or not an eligible contract in Section 5 and Section 6 concludes.[13]

[11] Cleared contracts may be subject to post-trade transparency through the CCP. Non-cleared contracts are not, at least until the beginning of 2018 when MiFID II became effective and the post-trade reporting requirements for OTC derivatives came into force. Transparency might offer opportunities for speculation to other traders, particularly for large transactions.

[12] The empirical literature on central clearing and CDS mainly uses DTCC data and is quite vast. Examples are Shachar (2012), Loon and Zhong (2014), Du et al. (2023), Siriwardane (2015), Mayordomo and Posch (2016), Pirrong (2011), Domanski et al. (2015), Lewandowska (2015), Amini et al. (2015), Menkveld et al. (2015), and Getmansky, Girardi and Lewis (2016).

[13] We also provide a rich appendix that contains the details of the regulatory framework (Appendix A), a simplified numerical example for the calculation of CCR (Appendix B), some features of (and issues with) our sample data (Appendix C), and detailed descriptive statistics (Appendix D).

2. Institutional setting

Once two counterparties agree to enter into a derivative contract, in our case a CDS, there are two possibilities. The first is a bilateral OTC transaction in which certain terms can be negotiated. In this case, since the majority of the contract is standardized, parties usually follow what is known as the ISDA standard, which includes a Master Agreement and the Credit Support Annex (CSA), a specific part of the contract that regulates collateral arrangements to mitigate CCR.[14]

Although bilateral OTC contracts can in principle be negotiated to determine whether collateral needs to be posted, CSAs are usually two-way agreements in which each party is required to post collateral. Once the initial collateral is posted, subsequent mark-to-market changes in the value of the contract will lead to additional collateral being posted or returned. The phased-in schedule for mandatory collection of initial margins, however, began only in September 2016,[15] and the mandatory collection of variation margins under EMIR became effective in March 2017.[16] Moreover, for certain OTC contracts, large dealers might decide not to sign CSAs, hence avoiding the obligation to post collateral and maintaining the full bilateral uncollateralized exposures of the CDS contract.[17] For these reasons, it could be that in our sample period, which ends in 2016, some OTC transactions may have occurred without initial or variation margin agreements in place.[18]

[14]An ISDA Master Agreement is the standard document used to govern OTC derivatives transactions. A typical Master Agreement contains standard terms that detail what happens if a default occurs to one of the parties and how OTC derivative transactions are terminated or "closed out" following a default. The 2002 version of the ISDA Master Agreement covers various default situations that could apply to one or both parties. However, in close-out situations, the Bankruptcy Event of Default will most commonly be triggered. A typical CSA includes the eligibility criteria for the collateral that can be posted, the initial margin requirement (or upfront payment in the case of a CDS), and the conditions that regulate a margin call, including frequency, among other legal details.

[15]See https://www.bis.org/bcbs/publ/d317.htm.

[16]See Commission Delegated Regulation (EU) 2016/2251 of 4 October 2016.

[17]Brunnermeier et al. (2013) documented that when sovereigns enter directly into a CDS contract as one of the two counterparties, they often do not post collateral; it is posted only by the other counterparty, usually the dealer.

[18]Despite the lack of mandatory collection of margins for OTC contracts during our sample period, the empirical evidence presented and discussed in Arora et al. (2012) suggests that many OTC contracts may nevertheless be collateralized.

Although information about collateral should in principle be available in the EMIR database, this information was not present in our data sample, so it cannot be used to identify OTC transactions that occurred without collateral from those with collateral under CSAs and Master Agreements.

The second possibility is to centrally clear the transaction.[19] Central clearing removes direct CCR and replaces it with exposure to a CCP. [20] Under central clearing, a bilateral trade between two counterparties is replaced by two separate trades with the CCP. Since the CCP creates a legal separation between the original counterparties, it absorbs the risk associated with a counterparty default and protects the non-defaulting counterparty. The effectiveness of a CCP is predicated in part on the requirement that clearing members post adequate capital and maintain sufficient collateral (margins) so that the potential impact of a defaulting clearing member can be mitigated.

Overall, centrally clearing a CDS transaction will result in a reduced risk weight, together with greater netting opportunities if the number of cleared transactions is high enough and the outstanding portfolio with the CCP is balanced (i.e., not too directional). In case of a bilateral trade, the capital charges reflect the CCR exposure, while in the case of a cleared transaction, the exposure is weighted substantially lower due to the removal of direct CCR. In fact, a risk weight of 2% is applied to the clearing member's trade exposure to CCPs, while a risk weight of 20% is applied to OTC derivatives. However, a clearing member would have to set aside more of their own funds for the pre-funded contribution to the default fund of the CCP(s).[21] Existing European capital requirements regulations (CRR) do not distinguish between a reference entity of the CDS that is a sovereign or a corporate; rather, the general riskiness of the reference entity is considered and an add-on applied based on its creditworthiness. A riskier reference entity increases risk exposure and consequent capital requirements.

In Table 1 and in more detail in Appendix B, we provide two numer-

[19] We provide a detailed description of the regulatory framework and the related literature in Appendix A.

[20] A qualifying central counterparty is an entity that is licensed to operate as a CCP (including a license granted by way of confirming an exemption) and is permitted by the appropriate regulator supervisory body to operate as such with respect to the products offered. See the current Basel Framework, available at https://www.bis.org/basel_framework/index.htm.

[21] See Article 308 of the CRR.

ical examples to calculate the CCR under the standardized approach. As documented by the two examples, the lower risk weights applied to cleared transactions substantially reduce the final risk-weighted exposure, creating incentives to clear a transaction in order to reduce CCR capital charges. These benefits need to be balanced, however, against the margin requirements imposed by the CCP and other clearing costs such as clearing fees and contributions to the CCP default fund, which we do not consider in our numerical examples. Overall, there appear to be relevant incentives to clear transactions in order to reduce CCR capital charges both when considering cleared trades vis-à-vis an uncollateralized OTC transaction and a collateralized OTC transaction under CSA and a Master Agreement. As noted above, our dataset does not provide information on whether or not non-centrally cleared transactions have been carried out under a CSA and Master Agreement, and hence whether they have occurred with or without collateral exchange. In testing our hypotheses, we are therefore estimating the average effects of our variables to assess the incentives to clear CDS trades vis-à-vis both collateralized and uncollateralized OTC transactions.

INSERT TABLE 1 HERE

What is presented above describes a typical tradeoff when both counterparties are clearing members. When transacting for their clients, the choice to clear a CDS contract may also be affected by the client's demand to clear and may depend on the details of the agreement between the dealer and the customer (i.e., the client clearing arrangement). There is also the possibility to clear a customer's transaction when one or both counterparties of the CCP are not direct clearing members, though we do not observe these transactions in our dataset. Becoming a clearing member is usually very expensive for small institutions or buy-side entities such as pension funds or insurance companies and entails a considerable administrative burden. A recent contribution by BIS-IOSCO (2022) discusses several issues related to client clearing, including restrictions on clearing for clients with insufficient transactions flows and difficulties for clients with directional portfolios.[22]

[22]There are essentially two models for client clearing: principal-to-principal and agency model. In the former, the clear trade is composed of two legs, the first being the trade between the client and the clearing member and the second a trade between the clearing member and the CCP. In the agency model, the clearing member only acts as a guarantor

In Europe, beyond certain interest rate derivative classes, the clearing obligation concerns only untranched index CDS classes. Hence, the decision to clear single-name CDS contracts has remained voluntary.[23] This creates the necessary conditions to study the factors that may influence the decision to (voluntarily) clear a single-name CDS contract. As discussed earlier, one or both parties might prefer to clear due to a better treatment in terms of capital requirement and risk exposures, or to increase netting efficiencies. Parties might also prefer to clear in order to avoid bilateral exchanges of collateral and margins, which might be managed more efficiently by the CCP when multiple positions are in place. When considering client clearing, the incentives for both parties depend on the details of the agreement and the choice of the model.[24] Our set of hypotheses in the following section is aimed at capturing some of the drivers of the decision to clear a contract, although we are aware that there might be other reasons, such as a client's demand, which we cannot test with our sample.[25]

3. Testable Hypotheses

As pointed out in the previous section, the parties in a CDS transaction might decide to clear a contract due to better treatment in terms of capital requirements and risk exposures or to increase netting efficiencies.

In this paper, we investigate the following question: why are only some sovereign CDS transactions currently eligible for central clearing actually being cleared, while others are not? We analyze from the clearing member

for the trade with the CCP, and the contract is between the client and the CCP; see Braithwaite (2016) and Bank for International Settlements and IOSCO (2022). In terms of exposures, if the clearing member is acting as a financial intermediary without any additional obligation, the exposure is equal to zero (CRR, Art 306(1)(c)), and the 2% risk weight applies to the client exposure if certain conditions are met (See Article 305 of the CRR).

[23]See the European Securities Markets Authority for further information regarding clearing obligation of derivative contracts, available at
`https://www.esma.europa.eu/regulation/post-trading/otc-derivatives-and-clearing-obligation`

[24]See supra note 22.

[25]Our dataset does not enable distinguishing between a dealer's proprietary trades and trades executed on behalf of clients and hence does not allow us to test whether client demands may be driving some of the dealer's clearing decisions.

perspective[26] the drivers of this decision by considering the following factors:

Hypothesis 1: Willingness to clear is higher when counterparty credit risk is higher.

CCR is the risk arising from the possibility that the counterparty may default on amounts owed on a derivative contract. The higher the counterparty's CDS spread, the larger the CCR exposure and benefit in terms of capital requirements reduction if the contract is cleared. Previous studies have documented how the creditworthiness of a counterparty may affect the demand for central clearing. Du et al. (2023) show that market participants manage counterparty risk by choosing counterparties that are less exposed to wrong-way risk and have better creditworthiness. We measure CCR as a function of the stand-alone risk of the counterparties, as captured by the CDS spreads of both seller and buyer. This variable should proxy for the potential reduction in capital requirements reflecting the preferential capital treatment the Basel III regulatory framework created for cleared contracts compared to OTC ones (Bank for International Settlements, 2014a), as described in Appendix B. Under these circumstances, risk management considerations regarding CCR exposure may provide a relevant incentive to clear in and of itself, independent of factors regarding the tradeoff between CCP margins and capital costs.

Hypothesis 2: Willingness to clear is higher if the reference entity is riskier.

The riskiness and liquidity of the underlying reference entity are closely related to both CCP margins and capital costs. When the reference entity is riskier, the counterparty risk measured by the exposure value is larger and the CCR capital charges for OTC contracts also become more severe. However, the initial and variation CCP margins and other clearing costs can also become higher. We formulate Hypothesis 2 as if the reduction in CCR capital requirements for riskier contracts were to prevail as a reason to clear over the increase in margin costs and other clearing costs. The riskiness of the contract is proxied in our analysis by (i) the Markit CDS quoted spread, (ii) the percentage change in the CDS quotes from the previous day, and (iii)

[26] When considering client clearing, the incentives for both parties depend on the details of the agreement and the choice of model (principal to principal or agency). As stressed above, our dataset does not report transactions involving client clearing.

a forecast of the volatility of the CDS using Exponential Weighted moving average volatility according to Riskmetrics (1996) parameters.[27]

Hypothesis 3: Willingness to clear is higher if a trade decreases the net outstanding exposure vis-à-vis the CCP.

Outstanding exposures with the transacting counterparty and the CCP both affect the decision to clear. Trades that decrease outstanding net exposures with the CCP help to reduce CCP margin requirements, while trades that reduce outstanding bilateral OTC exposures with the counterparty of a trade help to reduce capital charges. The decision to clear a contract depends on whether bilateral OTC netting efficiency prevails over the CCP multilateral netting, and on whether counterparties' incentives are aligned.[28] When considering this tradeoff, dealers face the problem of evaluating margin costs between bilateral and multilateral netting, as highlighted by Duffie and Zhu (2011) and Cont and Kokholm (2014).[29]

For each of our three sovereign CDS, we calculate the daily open position of the dealer with the CCP as a proxy of the inventories and the additional costs of a new trade.[30] Given that both counterparties have to post margins, they can achieve netting efficiencies if they reduce their exposures with the CCP. Our hypothesis is thus related to the net outstanding position with the CCP at the moment of the new trade: if a dealer is a net buyer with respect to the CCP, it prefers to clear the new trade only if it is going to take the opposite position (i.e., selling CDS) in order to reduce its overall CCP exposure. The same argument applies in the converse case; that is, when a dealer is a net seller with respect to the CCP, it prefers to clear when its next trade is a buy. It is crucial to recall that both parties must agree on the

[27]We use the logarithm in changes of the CDS Markit quotes and 150 daily observations to set the initial volatility and then apply the recursive formula using a rolling window of 75 days, with a decay factor of 0.94.

[28]Another potentially important aspect relates to the ability to re-hypothecate collateral. Whereas dealers typically re-hypothecate collateral received on OTC derivatives trades, collateral received on margin accounts at the CCP are not typically re-hypothecated. Although CCPs will rebate income earned on these assets, the relative marginal returns on the posted collateral can have an impact on the clearing decision.

[29]Generally, bilateral netting reduces the exposure to collateralize to a lesser extent than multilateral netting. However, in the case of counterparty concentration, bilateral netting can also achieve a significant reduction in such exposures.

[30]CCP usually applies a short charge when a dealer is a net seller of protection.

decision to clear. Unfortunately, with the available data, we cannot jointly test whether the probability to clear is larger when both traders have an incentive to clear for margin reasons. We can only investigate individually whether, if the buyer is a net seller or the seller is a net buyer, the probability to clear is higher.[31]

The three factors considered in our analysis are not independent. Clearly, Factors 2 and 3 are related, as incentives to flatten the book and reduce margin requirements with the CCP may be stronger for riskier reference entities. In addition, Factors 1 and 2 may be related through the possible interaction of CCR and reference entity risk when assessing capital charges. Table 1 and Appendix B provide two simplified examples to demonstrate how a potential reduction in CCR can provide sensible incentives for the decision to clear.

4. Data and definitions

4.1. Data

The database used for our analysis consists of all single-name sovereign CDS transactions made by EU financial institutions. Our analysis focuses on sovereign CDS specifically; Europe's most heavily traded sovereign CDS: IT, FR, and DE.[32] The initial daily data sample consists of 285,169 observations spanning 2004 to 2016. Roughly 70% of the observations are from 2016, where we observe a marked improvement in the quality and quantity of data.

According to Article 9 of the EMIR, the counterparties of a derivative contract have to report the details of the transaction, including modifications and cancellations, to a trade repository (TR) "no later than the business day following the conclusion, modification or termination of the contract." The set of details shall be reported to a trade repository registered according to

[31] The European TR data allow us to consistently retrieve inventory positions vis-à-vis the CCP only for European dealers. The hypothesis we are able to test, then, is whether or not, when a (European) buyer is a net seller with the CCP or a (European) seller is a net buyer with CCP, the probability to clear is higher.

[32] According to the globally aggregated transaction data provided by the DTCC on the Trade Information Warehouse (TIW) database, in the last quarter of 2016, IT CDS were the fifth most traded single-name CDS by average daily notional amount: FR CDS were in the 20th position and DE CDS in 54th. Other European sovereigns that are in the hundred most actively traded single-name CDS are Spain, Belgium, and Portugal. However, for data availability reasons, we restrict our analysis to only IT, FR, and DE.

Article 55 title VI or recognized in accordance with Article 77 of the EMIR. Consequently, information on EU counterparties' trades is made available to the European Securities Markets Authority (ESMA) and the European Systemic Risk Board (ESRB), while country-specific information is made available to the relevant domestic supervisory authorities. It is worth noting that the transaction is present in the dataset when at least one of the two counterparties is located in the EU. If for instance, two US counterparties are trading a European sovereign CDS, this transaction is not reported in our database. If one or both are domiciled in the EU, then the details are reported in one of the EU-registered trade repositories. According to the EMIR, the reporting obligation applies to contracts entered into before August 16, 2012 that are still outstanding and to any new contracts entered into after August 16, 2012.

We use the EU-wide dataset available from the ESRB.[33] A detailed presentation of the EMIR database and the cleaning procedures adopted to use the data appears in Appendix C; Abad et al. (2016) and Fache Rousová et al. (2015) provide a comprehensive description of the data structure and discuss issues related to data quality.

4.2. Definitions

What are the drivers of the decision to clear? We introduce several variables to test the hypotheses introduced in Section 3 and summarize them in Table 2.

INSERT TABLE 2 HERE

Our set of variables is related to the riskiness of the two counterparties involved in a trade, the characteristics of the contract and the liquidity risk of the trade, and the inventory position of the dealer with the CCP. In the same fashion, Table 3 provides the descriptive statistics for our sample.

INSERT TABLE 3 HERE

As a proxy for the riskiness of each counterparty in a trade, we use the quoted five-year CDS spread for both the buyer (*Spread B_Dealer*) and seller

[33] See Grothe et al. (2021) for a recent application using the same dataset related to CCP margins and collateral.

(*Spread S_Dealer*) of CDS protection. Table 3 shows that traders on average have a CDS spread of around 100 basis points (bps).

. The liquidity of a contract is captured by the variable *N. of Trades*, which represents the number of daily trades in the sample for each of the three sovereign CDS, conditional on observing at least one trade on that day; thus, zero-trade days are not considered in the statistics. The CDS contracts for all three sovereigns display a relatively similar average number of trades per day, ranging from 128 for IT to 191 for DE[34]. Using daily quotes from Markit, we construct three variables that capture different aspects of the riskiness for each reference entity: *CDS Volatility*, calculated as the exponential weighted moving average volatility of the daily quotes,[35] and the *CDS Quote Spread* and Δ *CDS Spread*, which represent the level of the current CDS spread for each country and the change in the spread from the previous day, respectively. While the three countries display a similar level of CDS volatility and change in CDS spread, their different levels of riskiness emerges from the the CDS spread level. The lowest CDS spread level belongs to DE (average of 12 bps), while IT displays a spread roughly 10 times larger (average of 128 bps). To control for the aggregate risk in financial markets, we also include the first difference of VIX (*Delta* VIX), the Chicago Board Options Exchange's measure of the expectation of volatility.

We extract from the TR the open positions of each trader with respect to each Clearing House in order to calculate the daily net exposure. Thus, the net position with the CCP_k is defined as:

$$Position\_wt\_CCP_{kijt} = \frac{Net\_Not.\_wt\_CCP_{kijt}}{G.\_Bought\_Not.\_Cl._{kijt} + G.\_Sold\_Not.\_Cl._{kijt}}, \tag{1}$$

where $Net\_Not.\_wt\_CCP_{kijt}$ represents the net notional position with the CCP k for the counterparty i on reference entity j and day t. The gross notional bought and sold amounts are similarly defined. By construction, this ratio varies from -1 to $+1$, where a negative number implies that the

[34]We have far more observations for IT than for DE and FR because there are fewer days with zero trades.

[35]The exponential weighted moving Average volatility is calculated using a constant smoothing lambda parameter of 0.94. The initial volatility is computed by considering a time interval of 150 observations with a rolling window of 75 observations according to Riskmetrics (1996).

counterparty is a net seller of CDS protection. The statistics in Table 3 show that most of the counterparties for DE and FR, whether buyers or sellers, have an average positive position (i.e., they are net buyers of CDS protection); the opposite is true for IT.

In order to formally test our three hypotheses, we estimate the following probit regressions separately for each sovereign CDS reference entity j (IT, DE, and FR):

$$Pr(Y_{i,j,t} = 1) = \alpha_0 + \beta \times X_{i,j,t} + \epsilon_{j,t}, \tag{2}$$

where $Y_{i,j,t}$ is equal to one if the transaction on the reference entity j by counterparty i has been centrally cleared, and zero otherwise. The matrix X contains a set of control variables that are different for each hypothesis tested, as well as different levels of fixed effects: country fixed effects, time fixed effects (week or month), and counterparty fixed effects (seller or buyer).

The sample we use to estimate Eq. (2) has some peculiar characteristics. As discussed in Appendix D, our database shows that transactions between two clearing members represent a significant fraction of cleared contracts. Moreover, under EMIR, EU authorities have full visibility only for contracts where at least one of the two counterparties is European, or the CCP through which the contract is cleared resides in Europe (i.e., ICE Europe). This means that if the contract is cleared through a non-European CCP (i.e., ICE Clear Credit US), and one of the two counterparties is non-European, the leg of the contract cleared by the non-European clearing member would not be present in our dataset. Among the three sovereign reference entities considered in our analysis, FR and DE CDS are cleared only through ICE Clear Credit US, while IT CDS are cleared through both ICE Europe and ICE Clear Credit US. For all three sovereign CDS, we are therefore able to retrieve ICE Clear Credit US inventory positions for European clearing members only, while for Italy sovereign CDS, we are able to retrieve ICE Europe inventory positions for both European and non-European clearing members. Our analysis of the drivers for central clearing is therefore limited only to transactions where at least one counterparty is a European clearing member and includes only the contracts that are eligible for central clearing.

5. Empirical Evidence

5.1. Riskiness of the counterparty

Hypothesis 1: Willingness to clear is higher when counterparty credit risk is higher.

In the first hypothesis, we test whether the riskiness of the counterparty (the CCR) *per se* can influence the willingness to clear a contract, independent of the riskiness and liquidity of the reference entity. In a CDS contract, the counterparty risks of the buyer and seller are asymmetric. If the seller defaults, the buyer of protection might lose the full notional amount in case of a credit event of an insured reference entity with a zero recovery rate. On the other hand, if the buyer of protection defaults, the maximum loss amounts only to the present value of the reference entity CDS premium. Because of this risk asymmetry, we postulate that the probability of clearing is more strongly related to the credit risk of the seller than the buyer. The proxy used for detecting the CCR is the dealer CDS spread with a tenor of five years.

We first estimate the model for the entire sample, including time and country fixed effects, and then separately for each sovereign CDS. To control as much as possible for time-varying risk factors, we include month and week fixed effects in our estimations.[36] All estimations also include the *Delta* VIX in the set of explanatory variables to control for general market risks.

INSERT TABLE 4 HERE

Table 4 shows the marginal effects of the probit estimation for the entire sample and for FR and DE CDS. In our data sample, we find no trades where CDS sellers belong to the same country as the reference entity. This is evidence that wrong-way risk is a first-order concern to market participants as documented by Du et al. (2023). In our data set, we also observe a lack of (European) clearing members buy-transactions of FR and DE CDS, which may stem from the fact that all European sovereign bonds (including Greek

[36]Although our dataset contains daily observations, there are several days when there are no transactions reported, preventing us from using daily fixed effects. For that reason, when including weekly fixed effects, the number of observations available for the estimation of the models is smaller.

bonds) are already exempt from capital requirements.[37] An additional reason is related to the fact that for most of DE and FR transactions, we cannot match the two legs of the transactions cleared with ICE Clear Credit US. Because of this, we are able to run our specification including only the CDS spread of the seller as an explanatory variable.

In all the specifications reported in Table 4, whether using monthly or weekly fixed effects, the coefficients of the CDS seller are positive and statistically significant at the 1% level, indicating that for all three sovereign CDS, the probability to clear is strongly related to the credit risk of the seller. As to the economic significance of the coefficients, all regression estimates report the average marginal effect. Since our explanatory variables are continuous, the coefficients should be interpreted as the instantaneous rate of change of the covariates with respect to the predicted probability of centrally clearing a transaction. Using the first specification in Table 4 as an example and looking at the CDS spread of the seller as our main covariate, its marginal coefficient is equal to 0.0044 and statistically significant at the 1% level. An increase of 10 bps in the CDS spread of the seller would on average increase the probability of clearing a transaction by 4.4%.

Interestingly enough, even without specific incentives related to relief in capital requirements, European banks sought to buy some protection on IT sovereign bonds, consistent with the evidence offered by Klingler and Lando (2018). For IT CDS transactions, we are therefore able to run our specifications including both the spread of the seller and the spread of buyer. Table 5 reports the results. The coefficients on the CDS spreads of both seller and buyer appear positive and significant across specifications. For the fraction of the IT CDS contracts cleared at ICE Europe, we are able to identify both counterparties clearing the contract with the CCP. In Table 5 Panel A we can thus report the results of the probit estimation, including both buyer and seller CDS spreads (specifications (5) and (6)). When doing so, we find that for both buyer and seller, CCR matters. However, the magnitude of the coefficient of the seller is roughly 1.5 times larger than the

[37] For sovereign bonds that do not demand capital and do not pose a substantial risk exposure, European banks may not deem it necessary to buy protection for hedging purposes. There might be other reasons, however, as discussed by Klingler and Lando (2018), to buy sovereign CDS. As documented by those authors, dealer banks might have incentives to buy a sovereign CDS in order to obtain capital relief for non-collateralized OTC derivatives with sovereigns. Buying a CDS of the sovereign would reduce their risk-weighted assets.

one of the buyer, indicating a higher propensity to clear in response to seller credit risk.

INSERT TABLE 5 HERE

One possible shortcoming of our analysis is that we have not yet specifically attempted to control for dealers' potential different baseline propensities to clear CDS contracts. In Panel B of Table 5, we re-run our regressions for IT, adding buyer and seller fixed effects to explicitly control for this while also maintaining time fixed effects (both monthly and weekly) to control for time-varying risk factors. The results confirm that even after controlling for dealers' baseline propensities to clear CDS contracts, CCR still drives the decision to clear.

Overall, our empirical findings in this section support Hypothesis 1. The spread of CDS dealers has a positive and significant relation with the probability to clear a contract, particularly regarding the CDS spread of the seller of protection.

5.2. Riskiness of the reference entity

Hypothesis 2: Willingness to clear is higher if the reference entity is more risky.

Hypothesis 2 investigates the drivers of clearing by looking at a contract's characteristics. In Section 2 we discussed how some of these variables capture dimensions that might affect both capital requirements and CCP margins but have a contrasting effect on the decision to clear. The empirical analysis here allows us to assess which effect prevails.

Table 6 reports the marginal effects of the probit model for the entire sample and for DE and FR sovereign CDS, while Table 7 reports the results for IT sovereign CDS.

INSERT TABLE 6 and TABLE 7 HERE

Models (1) and (2), which include all sovereigns and control for country and time fixed effects (both monthly and weekly), show that the contract's characteristics that are major drivers for central clearing are related to CCR exposure (*CDS Quote Spread* is positive and significant), trade size (*Log Notional Amount* is positive and significant), and liquidity (*N. of trades* is negative and significant). These aggregate results, however, may mask some variability that exist in the cross-section of our sample. In the following specifications, we attempt to uncover these differences by analyzing each sovereign CDS separately. When doing so, we stop controlling for time-varying risk factors using weekly fixed effects to avoid potential issues with the low degrees of freedom stemming from fewer observations and large number of covariates, and use instead only monthly fixed effects and *Delta* VIX.

In line with Hypothesis 2, when the reference entity is riskier, the probability of clearing the contract is larger. The coefficient for the variable *CDS Quote Spread* is positive and statistically significant at the 1% level for FR and IT. An increase of 10bp in the *CDS Quote Spread* increases the probability to clear by 2.5% and 0.4% respectively. Higher potential margin and clearing costs, therefore, do not prevent the counterparties from agreeing on clearance as considerations about CCR exposures appear to prevail in the decision to clear. For DE, the coefficients do not appear significant. This could be motivated by the fact that this variable is quite stable over time and that the riskiness of DE is so low that it does not have a substantial impact on either margin costs or CCR exposures (see summary statistics in Table 2).

The second variable that we consider is the change in the CDS spread level, Δ*CDS Spread*. As the estimated coefficients show, this variable has a negative effect for DE and FR, albeit statistically significant only for FR. This is in line with the idea that an increase in the CDS spread of the reference entity increases margins, and thus reduces incentives to clear. For IT, the sign of the estimated coefficient is positive and significant in columns (1)–(4) when including either the seller's or the buyer's spread. Once we control for both and add monthly fixed effects (specification 6) the coefficient is no longer significant. [38]

Overall, the results on the change in the CDS spread provide some evidence that the increase in the risk of the reference entity may increase clearing, in line with Hypothesis 2 and CCR exposure motivations, but only for the riskiest country in the sample. For DE and FR, margin and clearing costs appear to prevail over CCR exposures regarding the decision to clear.

The volatility of the quoted CDS spread, *CDS Volatility*, has a negative

[38] Notice that for IT we observe the same negative coefficient as FR and DE when we control for both the risk of the buyer and the seller but we omit monthly fixed effects (specification 5).

sign for FR and DE, although is significant only for DE when including monthly fixed effects, revealing that the probability of clearing decreases when the volatility of the two sovereign contracts increases. The sign of the coefficient is positive and significant for IT in some of the specifications, indicating that considerations regarding CCR exposures may prevail over CCP margin and clearing costs.

Overall, these findings confirm that higher levels of risk of the reference entity may increase the probability of clearing, in line with Hypothesis 2, but only for the riskiest country in the sample, IT, while the opposite appears to be true for FR and DE. Our results complement those of Klingler and Lando (2018), according to whom an increase in the riskiness of the CDS for a sovereign might have an impact on the credit valuation adjustment related to other uncollateralized derivative positions (most likely IRS), thus providing an incentive for financial institutions to buy sovereign protection. Our work complements this finding by examining how the riskiness of a CDS relates to the subsequent decision by financial institutions to clear a CDS transaction.

When we turn to trade size (*Log Notional Amount*), the analysis shows that the larger the volume of a transaction, the greater the probability of clearing. Potential differences in post-trade transparency between cleared and non-cleared contracts suggest that larger trades may be less likely to be cleared to avoid opportunistic trading behaviors by other market participants. Our empirical results, however, reveal the opposite. If the trader has to choose between the possibility of disclosing a large position on a contract or incurring a large CCR exposure, there seems to be a preference for reducing CCR exposure. This result is significant at the 1% level, including the time fixed effects analysis for FR and IT. However, for DE, the safest country in our sample, the estimated coefficient is not statistically significant, indicating that CCR exposures are less relevant for the clearing decision.

Finally, the number of transactions *N. of trades* loads with a negative sign for all three sovereigns, although the results become less significant when including monthly fixed effects, revealing that the incentive to clear may be lower when a contract is heavily traded. These findings suggest that an increase in transactions is likely to correspond to a lower proportion of contracts being cleared, as the exposures arising from these trades might face lower capital charges and can also be more easily offset in the OTC market. Notably, when we control for the CDS spreads of both seller and buyer in IT, the sign of this covariate flips, indicating that an increase in trading activity may translate into a higher propensity to clear, potentially due to greater concerns about default and CCR. It is important to note that an increase in the number of transactions, in addition to affecting the decision to clear through the tradeoff between lower CCP margins and capital costs, may also reflect speculative market behaviors. Unfortunately, we could only conjecture about the main drivers behind the change in the sign of this variable, which may be otherwise due to the correlation between the change in the CDS spreads of buyer and seller and the number of transactions.

In general, our analysis confirms Hypothesis 2 only for IT CDS contracts: the propensity to clear is greater when the reference entity is riskier, and hence CCR exposures motivation prevails on the margin and clearing costs motivation for the decision to clear. For the DE CDS, by contrast, it seems that the incentives that prevail for clearing are those provided by margin and clearing costs, while the results are mixed for FR. The difference in results across the three sovereign reference entities indicates the need to perform a separate analysis of each.

5.3. Net outstanding exposure vis-à-vis the CCP

Hypothesis 3: Willingness to clear is larger if the trade decreases the net outstanding exposure vis-à-vis the CCP.

In this section, we consider the position of the single dealer vis-à-vis the CCP. We model the decision to clear based on the intuition that if a transaction helps reduce net outstanding positions with the CCP, dealers should have an incentive to clear it, as that would lower the amount of collateral that has to be posted with the CCP. In principle, if the buyer of a new contract is a net seller vis-à-vis the CCP, it would have more incentive to go through the CCP, as that would reduce outstanding exposures to the CCP and thus margin requirements. The same argument should also apply to the seller of a new contract who a net buyer vis-à-vis the CCP.

In order to capture this behavior, we use the previous-day position of the counterparty vis-à-vis the CCP (see Eq. (1.)) with respect to each reference entity (DE, FR, IT). We define a position as "flat" when the ratio between net and gross Notional outstanding is between +5% and −5%. A counterparty is a net buyer if this ratio is above 5% and net seller if the ratio is below minus 5%. A number close to zero means that the counterparty is almost flat, while a number close to +1 and −1 displays a directional exposure to the CCP. We combine this information with the side of each trader (buyer or seller) and isolate the two relevant cases: (i) when the buyer of a new contract is a net seller vis-à-vis the CCP, and (ii) when the seller of a new contract is a net buyer vis-à-vis the CCP.

In section 5.1, we have discussed the lack of sufficient observations in our sample to run a meaningful analysis regarding (European) clearing member decisions to buy FR and DE sovereign CDS.[39] We face the same limitations here and hence study only sell-side clearing decisions for these two sovereign reference entities. Table 8 shows the marginal effect of our probit regression when we include explanatory dummies capturing the outstanding position of the seller vis-à-vis the CCP for DE and FR sovereign CDS (Panel A) and the seller and buyer vis-à-vis the CCP for IT sovereign CDS (Panel B).[40]

INSERT TABLE 8 HERE

For all three countries, when the seller is a net buyer with respect to the CCP and hence has an incentive to clear the contract to flatten its position with the CCP, the propensity to clear is higher. The estimated coefficients are positive and significant across almost all specifications. The results are robust to the inclusion of time fixed effects and the inclusion of the seller's spread. When focusing on Panel B, buyers' clearing decisions also confirm Hypothesis 3. When a buyer enters a trade of IT CDS and already has a net position as seller vis-à-vis the CCP, the propensity to clear the contract is higher. These results are robust to the inclusion of time fixed effects.

In section 5.1, we have discussed the natural asymmetry in counterparty risk between the seller of a CDS and a buyer. This risk asymmetry would suggest that CCP's collateral requirements should be more onerous for dealers that are net sellers vis-à-vis the CCP than dealers that are net buyers. Based on this, we would expect that the relative magnitude of our coefficients for IT should be stronger when the buyer of a given contract is a net seller with the CCP than when the seller is a net buyer with the CCP. We would expect these results to hold true, however, only ceteris paribus. If, for

[39] One possible explanation for why European clearing members largely abstained from buying DE and FR CDS during our sample period is that all European sovereign bonds (including Greek bonds) were already exempt from capital requirements.

[40] Even though trades in European sovereign CDS between two European counterparties are possible in principle (and indeed observed in our dataset), we notice very few such transactions. The vast majority of the transactions captured in our sample are between a European clearing member and a non-European clearing member.

example, the CDS buyer holds more power than the seller when negotiating the possibility of clearing a contract, then the incentives deriving from its margin requirements with the CCP may affect the probability to clear more (rather than less) than those of the seller. Other factors may also prevent us from properly analyzing the effects of the asymmetry between net seller and net buyer. In fact, margin requirements are dependent on information to which we do not have access, such as the dealer's overall outstanding portfolio with the CCP. Because of these limitations, we do not attempt to derive conclusions on the relative magnitude of the coefficients in columns (1)–(4) and (5)–(8) of Table 8 (Panel B) for IT.

Even though we do not see the full positions of dealers with the CCP in our data set, we run in Table 9 an additional specification in which we analyze how dealers' outstanding exposure to the CCP aggregated across our three underlying contracts affects the decision to clear the CDS. As a reminder, our data sample has two CCPs clearing different contracts: FR and DE CDS are cleared only through ICE Clear Credit US, while IT CDS are cleared through both ICE Europe and ICE Clear Credit US (see section 4.2). To keep our analysis simple, in Table 9 we assess the probability of clearing only FR and DE CDS through ICE Clear Credit US using dealers' outstanding exposures at ICE Clear Credit US, aggregated across the three underlying CDS. The results confirm our main hypothesis. When the seller (buyer) is a net buyer (seller) with respect to the CCP across all three underlying contracts and hence has an incentive to clear the contract to flatten its overall position with the CCP, the propensity to clear is higher. The estimated coefficients are positive and significant across all specifications, and the results are robust to the inclusion of time-fixed effects.

As explained in detail in Section 4 and Appendix C, our database does not allow us to identify the identities of both parties for a large fraction of the cleared transactions. Therefore, in our analysis, we could not disentangle cases when both counterparties had incentives to clear from cases when only one did, especially when European and non-European counterparties were involved. Even with those data limitations, we could still conclude that the results in Table 8 and 9 confirm Hypothesis 3.

6. Conclusion

This paper is a first attempt to empirically analyze whether post-crisis regulatory reforms developed by global standard-setting bodies have created appropriate incentives to centrally clear over-the-counter derivative contracts. We use a sample from the confidential European trade repository data governed by the European Market Infrastructure Regulation on single-name European sovereign credit default swaps to test whether clearing members' incentives to clear a CDS contract are related to the (i) riskiness of the counterparty, (ii) characteristics of the contract that affect both the counterparty clearing house margins and capital requirements related to counterparty credit risk, and (iii) the clearing member's net exposure vis-à-vis the CCP.

Our results show that a large majority of the contracts could be cleared if the clearing members involved in the trade were to agree. We also find that a large majority of the transactions cleared in our sample were between CCP clearing members and find little evidence of the clearing of transactions by non-clearing members, independent of whether they are subject to capital requirements.

With a focus on contracts that are eligible for clearing, we investigate factors that drive clearing members' decision to clear. We find that both CCR capital charges for OTC contracts and CCP margin requirements are relevant for the decision to clear. Higher CCRs of both buyer and seller appear to be a factor that significantly increases the probability of clearing. However, the magnitude and significance of the response to the seller's credit risk is larger than that of the buyer's, providing evidence of the asymmetry in CCR that is intrinsic to CDS contracts.[41]

When we analyze how clearing incentives relate to the several characteristics of a contract, we find differing results across the three European sovereign CDS included in our sample. The propensity to clear is higher if the reference entity becomes riskier, but this holds true only for Italy, the riskiest sovereign CDS. For the other two, Germany and France, the opposite holds true. Our findings suggest that CCP margin and clearing cost savings considerations may be the main force behind the decision to clear for safer instruments, while CCR exposures and capital charges may prevail for riskier ones.

Finally, we find that clearing members strategically clear transactions

[41] If the seller of a CDS contract defaults, the buyer of protection might lose the full notional amount in case of a credit event of the insured reference entity with zero recovery rate. On the other hand, if the buyer of protection defaults, the maximum loss amounts only to the present value of the reference entity's CDS premium.

that help them reduce outstanding net exposures with the CCP and hence margin requirements. When a firm enters a trade as a buyer (seller), the propensity to clear the contract increases if it has a net outstanding position as a seller (buyer) vis-à-vis the CCP, indicating that incentives to reduce outstanding portfolio net positions (and hence margin requirements) with the CCP matter for the decision to clear a new trade.

Our results can be informative from a policy perspective, though the limitation of our data sample suggests using caution in generalizing them.[42] First, we show that clearing activity of non-clearing members, independent of whether they are subject to capital requirements, is much lower than that of clearing members.[43] This result can be relevant for financial stability, especially in light of the fact that after the financial crisis, non-clearing members became risk absorbers (i.e., net sellers of protection) in the system. While the clearing benefits for these firms may naturally be lower than those of clearing members,[44] other costs such as CCP default fund charges and clearing fees may constitute a meaningful obstacle to client clearing. Further assessment of these costs, the supply of these services by the market, and the potential constraints provided by recent financial regulation on clearing services may be warranted. Regarding the decision to clear for clearing members, we find that both regulatory factors (i.e., capital requirements) and non-regulatory factors like netting efficiency are important. However, factors related to contract characteristics have different impacts on the incentives to clear for reference entities with different risk profiles. In light of these results, policymakers may wish to reflect on whether the recent introduction of initial and variable margin requirements for bilateral OTC transactions creates enough incentives to clear contracts, particularly for non-clearing members with no capital requirements. Further analysis may be warranted across a larger data sample of CDS contracts and counterparties to assess the potential non-linearity of incentives related to clearing members' CCR capital

[42] The database used in the analysis is limited both in the number of reference entities included and the identities of the two parties in a cleared transaction.

[43] Despite some recent efforts by a group of global asset managers to clear single-name contracts, the discrepancy in clearing activity between clearing and non-clearing remains noticeable.

[44] Multilateral netting by CCP is typically less effective because non-clearing members tend to have more directional portfolios concentrated across a smaller number of counterparties

charges and CCP margin requirements.

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Tables

Table 1: **Example 1**
A German bank sells a 5Y CDS written on IT as reference entity to a US bank. See Appendix B for details.

	Centrally cleared	Bilateral OTC (CSA with margins)	Bilateral OTC (uncollateralized)
Seller			
Exposure value (counterparty risk)	0.822	0.822	1.890
Applicable risk weight	2%	20%	20%
Risk-Weighted Exposure Amount	0.016	0.164	0.378
Buyer			
Exposure value (counterparty risk)	0.822	0.822	2.450
Applicable risk weight	2%	20%	20%
Risk-Weighted Exposure Amount	0.016	0.164	0.490

Example 2
A Dutch bank sells a 5Y CDS written on DE as reference entity, to a US bank. See Appendix B for details.

	Centrally cleared	Bilateral OTC (CSA with margins)	Bilateral OTC (uncollateralized)
Seller			
Exposure value (counterparty risk)	0.587	0.587	1.330
Applicable risk weight	2%	20%	20%
Risk-Weighted Exposure Amount	0.012	0.117	0.266
Buyer			
Exposure value (counterparty risk)	0.587	0.587	1.372
Applicable risk weight	2%	20%	20%
Risk-Weighted Exposure Amount	0.012	0.117	0.274

Table 2: **Description of variables**
The table shows the explanatory variables used for testing the three hypotheses: 1) CCR 2) reference entity risk, and 3) outstanding positions with the CCP. The table reports the variables considered, their descriptions, and the data source.

Variable	**Description**	**Data source**
Spread Buyer - 5Y	Buyer CDS spread with 5-years tenor	Markit
Spread Seller - 5Y	Seller CDS spread with 5-years tenor	Markit
N. of Trades	Daily trades: Number of daily trades of a particular reference entity	EMIR
Log Notional Amount	Trade volume: The logarithm of the contracts' notional amount	EMIR
CDS Volatility	Exponential weighted moving average volatility of the CDS spread market	Markit
CDS Quote Spread	CDS quote spread of a particular reference entity	Markit
Δ CDS Spread	CDS spread of a particular reference entity change	Markit
Seller is net buyer with CCP (Dummy)	Net buyer sells protection: trades where the seller of the CDS is a net buyer with the CCP	EMIR
Buyer is net seller with CCP (Dummy)	et seller buys protection: trades where the buyer of the CDS is a net seller with the CCP	EMIR
Buyer's exposure to the CCP	Inventories of the buyer: net open position with the CCP at a reference entity level	EMIR
Seller's exposure to the CCP	Inventories of the seller: net open position with the CCP at a reference entity level	EMIR
Delta VIX	First difference of the VIX Index	CBOE

Table 3: **Descriptive statistics**
The table shows descriptive statistics for the explanatory variables used for testing the three hypotheses: 1) CCR, 2) reference entity risk, and 3) outstanding positions with the CCP. The data come from TRs under the EMIR reporting requirement for the year 2016, Markit, and CBOE.

	DE			FR			IT		
Variables	**N. Obs.**	**Mean**	**S.dev.**	**N. Obs.**	**Mean**	**S.dev.**	**N. Obs.**	**Mean**	**S.dev.**
Spread Buyer - 5Y	877	99.707	18.813	2120	99.887	16.098	5838	97.589	24.684
Spread Seller - 5Y	895	99.278	18.501	1940	101.141	21.223	4997	99.385	26.437
N. of trades	1363	191.511	192.203	2748	173.081	156.305	8289	128.257	138.735
Log Notional Amount	1332	15.838	2.445	2666	15.432	2.297	8053	16.112	1.882
CDS Volatility	1147	0.031	0.017	2360	0.027	0.016	7391	0.028	0.012
CDS Quote Spread	1336	12.565	10.093	2705	30.107	16.128	8219	128.765	41.065
Delta CDS Spread	1336	0.036	0.659	2705	0.231	1.172	8219	0.172	4.650
Buyer's exposure to the CCP	231	0.273	0.439	674	0.107	0.300	2947	-0.064	0.310
Seller's exposure to the CCP	207	0.257	0.424	521	0.053	0.393	2653	-0.089	0.323
Delta VIX	486	-0.015	1.609	486	-0.015	1.609	486	-0.015	1.609

Table 4: **Hypothesis 1: CCR**
The table shows the marginal effects of the estimated probit model for all contracts and for contracts having DE and FR sovereign CDS separately as reference entities, where at least one of the two counterparties is a European clearing member. The dependent variable is a dummy variable equal to one when the contract is cleared. The table reports the impact of the CDS spread of the (European) seller on the probability of clearing the contract. The data come from TRs under the EMIR reporting requirement for the year 2016.

	ALL SAMPLE		**DE**		**FR**	
Models	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Spread Seller - 5Y	0.0044***	0.00045***	0.0107***	0.00677***	0.00399***	0.00464***
	(0.00237)	(0.00235)	(0.00201)	(0.000954)	(0.000596)	(0.000557)
Spread Buyer - 5Y						
Delta VIX	-0.00138	-0.00029	-0.0279**	-0.0233**	0.00706	-0.00746
	(0.0041)	(0.0036)	(0.0114)	(0.00953)	(0.00773)	(0.00687)
Observations	6,413	6,474	479	767	1,540	1,631
Fixed Effects	CW	CM	W	M	W	M

Robust standard errors in parentheses: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.
Fixed effects: C=Country, M=Month, W=Week

Table 5: **Hypothesis 1: CCR for IT CDS**
Panel A shows the marginal effects of the estimated probit model for the contracts with IT CDS as reference entity, and where counterparties are clearing members. The dependent variable is a dummy variable equal to one when the contract is cleared. The explanatory variables used are the buyer CDS spread (*Spread Buyer - 5Y*) and the seller CDS spread (*Spread Seller - 5Y*), both with 5 year tenors. Panel B includes also buyer or seller fixed effects. The data come from TRs under the EMIR reporting requirement for the year 2016.

Panel A

Models	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Spread Buyer - 5Y			0.00196***	0.00199***	0.00268***	0.000805***
			(0.000282)	(0.000271)	(0.000576)	(0.000168)
Spread Seller- 5Y	0.00454***	0.00442***			0.00346***	0.00124***
	(0.000274)	(0.000272)			(0.000653)	(0.000213)
Delta VIX	0.00358	0.00213	0.00596	-0.000669	-0.0322***	-0.00331
	(0.00523)	(0.00491)	(0.00539)	(0.00545)	(0.0124)	(0.00544)
Observations	4,019	4,076	4,006	4,067	921	2,168
Fixed Effects	W	M	W	M	W	M

Robust standard errors in parentheses: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.
Fixed effects: M=Month,W=Week.

Panel B

Models	**(1)**	**(2)**	**(3)**	**(4)**
Spread Buyer - 5Y			0.00619***	0.00626***
			(0.00107)	(0.00123)
Spread Seller- 5Y	0.00383***	0.00426***		
	(0.00126)	(0.00111)		
Delta VIX	0.0117	0.00477	0.0324***	-0.00515
	(0.00991)	(0.0192)	(0.0123)	(0.0203)
Observations	685	443	677	452
Fixed Effects	M-Buyer	W-Buyer	M-Seller	W-Seller

Robust standard errors in parentheses: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.
Fixed effects: M=Month,W=Week.

Table 6: **Hypothesis 2: Reference Entity Risk**
The table shows the marginal effects of the estimated probit model for all contracts and for contracts having DE and FR CDS as reference entities separately, where both of the counterparties are clearing members. The dependent variable is a dummy variable equal to one when the contract is cleared. The explanatory variables used are the CDS spread of the reference entity (*CDS Quote Spread*), the first difference of the CDS spread (Δ *CDS Spread)*, the logarithm of the notional amount of the contract (*Log Notional Amount*), the exponential weighted moving average of the CDS returns of the reference entity (*CDS Volatility*), the number of the daily transactions (*N. of trades*). Seller CDS spread and Delta VIX are included as controls. The data come from TRs under the EMIR reporting requirement for the year 2016.

	ALL SAMPLE		DE		FR	
Models	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
CDS Quote Spread	0.000317**	0.000649***	0.000485	-0.000335	0.00191***	0.00252***
	(0.000159)	(0.000159)	(0.00160)	(0.00165)	(0.000560)	(0.000569)
Delta CDS_Spread	-0.000928	0.00125	-0.0252	-0.0367	-0.0193**	-0.0250***
	(0.00156)	(0.00168)	(0.0292)	(0.0343)	(0.00890)	(0.00877)
CDS Volatility	-1.287***	-0.117	-3.598***	-8.916***	-2.886***	-1.439
	(0.416)	(0.530)	(1.248)	(1.797)	(0.609)	(1.018)
Log Notional Amount	0.0561***	0.0571***	-0.00198	-0.00601	0.0411***	0.0430***
	(0.00400)	(0.00394)	(0.0108)	(0.00916)	(0.00618)	(0.00710)
N. of Trades	-0.000342***	-0.000127**	-0.000465***	0.00009	-0.000213***	-0.000114
	(0.00004)	(0.00005)	(0.00009)	(0.000174)	(0.00006)	(0.00009)
Spread Seller - 5Y	0.00346***	0.00421***	0.00403***	0.00631***	0.00385***	0.00461***
	(0.000221)	(0.000250)	(0.000898)	(0.00112)	(0.000430)	(0.000611)
Delta VIX	-0.000457	0.0053108	-0.00867	-0.0207	-0.00217	0.00647
	(0.00445)	(0.004292)	(0.00956)	(0.0136)	(0.00713)	(0.00767)
Observations	5,537	5,537	631	631	1,399	1,399
Fixed effects	C	CM		M		M

Robust standard errors in parentheses: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.
Fixed effects: C=Country, M=Month

Table 7: **Hypothesis 2: Reference Entity Risk for IT CDS**
The table shows the marginal effects of the estimated probit model for contracts having IT CDS as a reference entity, and where both of the counterparties are clearing members. The dependent variable is a dummy variable equal to one when the contract is cleared. The explanatory variables used are the CDS spread of the reference entity (*CDS Quote Spread*), the first difference of the CDS spread (Δ*CDS Spread*), the logarithm of the notional amount of the contract (*Log Notional Amount*), the exponential weighted moving average of the CDS returns of the reference entity (*CDS Volatility*), the number of the daily transactions (*N. of trades*). Seller and buyer CDS spreads and Delta VIX are included as controls. The data come from TRs under the EMIR reporting requirement for the year 2016.

	IT					
Models	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
CDS Quote Spread	0.000441**	0.000736***	0.000271	0.000614***	0.000168	0.000399***
	(0.000181)	(0.000187)	(0.000175)	(0.000174)	(0.000119)	(0.000134)
Delta CDS_Spread	0.00406**	0.00797***	0.000890	0.00607***	-0.00177**	-0.000275
	(0.00178)	(0.00199)	(0.00179)	(0.00201)	(0.000755)	(0.00241)
CDS Volatility	-0.283	1.365*	0.421	2.424***	1.509***	0.592
	(0.605)	(0.806)	(0.593)	(0.783)	(0.367)	(0.585)
Log Notional Amount	0.0680***	0.0680***	0.0751***	0.0689***	0.0175***	0.0203***
	(0.00470)	(0.00483)	(0.00436)	(0.00422)	(0.00294)	(0.00340)
N. of Trades	-0.000341***	-0.000205***	-0.000375***	-0.000152**	0.000091***	0.000382***
	(0.00005)	(0.00007)	(0.00005)	(0.00006)	(0.00003)	(0.00009)
Delta VIX	-0.00580	-0.00845	0.000817	0.000594	0.0171***	0.0207***
	(0.00607)	(0.00620)	(0.00586)	(0.00573)	(0.00282)	(0.00755)
Spread Seller - 5Y			0.00321***	0.00386***	0.000866***	0.00148***
			(0.000256)	(0.000276)	(0.000169)	(0.000247)
Spread Buyer- 5Y	0.000970***	0.00190***			0.000518***	0.00120***
	(0.000262)	(0.000278)			(0.000132)	(0.000200)
Observations	3,521	3,521	3,507	3,507	2,310	1,834
Fixed Effects		M		M		M

Robust standard errors in parentheses: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.
Fixed effects: M=Month.

Table 8: **Hypothesis 3: Outstanding Positions with the CCP**
The table shows the marginal effects of the estimated probit model for contracts having DE and FR CDS (Panel A) and IT CDS (Panel B), and where counterparties are clearing members. The dependent variable is a dummy variable equal to one when the contract is cleared. The explanatory variables used are a dummy equal to one when the CDS seller is a net buyer with the CCP, and a dummy equal to one when the CDS buyer is a net seller with the CCP. Seller CDS spreads and Delta VIX are included as controls. The data come from TRs under the EMIR reporting requirement for the year 2016.

Panel A

	DE				FR			
Models	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Seller is net buyer with CCP 1 (Dummy)	0.513***	0.630***	0.467***	0.686***	0.0709	0.0939***	0.0602	0.107***
	(0.118)	(0.0948)	(0.115)	(0.100)	(0.0473)	(0.0323)	(0.0533)	(0.0403)
Spread Seller - 5Y		0.00423***		0.00677***		0.00365***		0.00414***
		(0.000845)		(0.00119)		(0.000416)		(0.000568)
CDS Quote Spread	0.000987	0.00174	-0.0003	-0.000495	0.00214***	0.00212***	0.00279***	0.00250***
	(0.00153)	(0.00150)	(0.00158)	(0.00152)	(0.000586)	(0.000523)	(0.000591)	(0.000520)
Delta CDS_Spread	-0.0494	-0.0236	-0.0770**	-0.0318	-0.0354***	-0.0245***	-0.0369***	-0.0269***
	(0.0306)	(0.0269)	(0.0357)	(0.0312)	(0.0135)	(0.00872)	(0.0141)	(0.00865)
CDS Volatility	-4.231***	-3.735***	-10.11***	-8.494***	-3.756***	-2.884***	-1.538*	-1.327
	(1.108)	(1.229)	(2.242)	(1.660)	(0.714)	(0.594)	(0.881)	(0.934)
Log Notional Amount	0.0123	0.00551	0.00727	-0.00522	0.0579***	0.0366***	0.0570***	0.0351***
	(0.0108)	(0.0112)	(0.00969)	(0.00833)	(0.00645)	(0.00601)	(0.00753)	(0.00670)
N. of Trades	-0.000652***	-0.000621***	-0.000278*	-0.000188	-0.000272***	-0.000210***	-0.000261**	-0.000155*
	(0.00008)	(0.00008)	(0.000153)	(0.000190)	(0.00007)	(0.00006)	(0.000102)	(0.00008)
Delta VIX	0.00650	0.0231***	0.00200	0.000203	-0.00496	-0.000335	0.0136	0.00783
	(0.00978)	(0.00822)	(0.0109)	(0.0165)	(0.00786)	(0.00703)	(0.00889)	(0.00720)
Observations	828	627	828	627	1,687	1,379	1,687	1,379
Fixed Effects			M	M			M	M

Robust standard errors in parentheses: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Fixed effects: M=Month.

Panel B

	IT							
Models	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Seller is net buyer with CCP 2 (Dummy)	0.528***	0.600***	0.414***	0.536***				
	(0.105)	(0.0976)	(0.110)	(0.120)				
Buyer is net Seller with CCP 2 (Dummy)					0.302***	0.285***	0.155***	0.142**
					(0.0566)	(0.0667)	(0.0597)	(0.0603)
Spread Seller - 5Y		0.00326***		0.00380***				
		(0.000252)		(0.000271)				
Spread Buyer - 5Y						0.00122***		0.00205***
						(0.000287)		(0.000271)
CDS Quote Spread	0.000490***	0.000276	0.000794***	0.000519***	0.000483***	0.000358**	0.000809***	0.000590***
	(0.000162)	(0.000172)	(0.000167)	(0.000172)	(0.000162)	(0.000171)	(0.000167)	(0.000184)
Delta CDS_Spread	0.00599***	0.000246	0.00890***	0.00547***	0.00642***	0.00308*	0.00914***	0.00683***
	(0.00170)	(0.00177)	(0.00181)	(0.00201)	(0.00170)	(0.00185)	(0.00181)	(0.00195)
CDS Volatility	-0.393	0.422	1.230	2.314***	-0.517	-0.372	1.220	1.147
	(0.564)	(0.584)	(0.763)	(0.767)	(0.565)	(0.636)	(0.763)	(0.785)
Log Notional Amount	0.0964***	0.0753***	0.0925***	0.0705***	0.0963***	0.0738***	0.0929***	0.0728***
	(0.00402)	(0.00414)	(0.00410)	(0.00404)	(0.00404)	(0.00410)	(0.00412)	(0.00507)
N. of Trades	-0.000537***	-0.000422***	-0.000391***	-0.000223***	-0.000504***	-0.000330***	-0.000362***	-0.000227***
	(0.00005)	(0.00005)	(0.00006)	(0.00007)	(0.00005)	(0.00006)	(0.00005)	(0.00007)
Delta VIX	-0.0141**	0.0162***	-0.0113**	0.0131**	-0.0199***	-0.00219	-0.0151***	-0.00490
	(0.00552)	(0.00572)	(0.00553)	(0.00635)	(0.00537)	(0.00593)	(0.00533)	(0.00609)
Observations	4,981	3,490	4,981	3,490	4,981	3,472	4,981	3,472
Fixed Effects			M	M			M	M

Robust standard errors in parentheses: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Fixed effects: M=Month

Table 9: **Hypothesis 3: Outstanding Positions with the CCP combined**
The table shows the marginal effects of the estimated probit model for all contracts having DE and FR CDS, and where counterparties are clearing members. The dependent variable is a dummy variable equal to one when the contract is cleared. We aggregate the outstanding positions with the US CCP (Ice Clear Credit) which is accepting all three reference entities, and we calculate the explanatory variables, which are a dummy equal to one when the CDS seller is a net buyer with the US CCP, and a dummy equal to one when the CDS buyer is a net seller with the US CCP. The additional explanatory variables are the same as in the previous models. Seller and buyer CDS spreads are included as controls where appropriate. The data come from TRs under the EMIR reporting requirement for the year 2016.

Models	**(1)**	**(2)**	**(3)**	**(4)**
Seller is net buyer with CCP 1 (Dummy)	0.180***	0.185***	0.136***	0.170***
	(0.0403)	(0.0296)	(0.0444)	(0.0352)
Spread Seller - 5Y		0.00368***		0.00484***
		(0.000385)		(0.000567)
CDS Quote Spread	0.000909*	0.00110**	0.00149***	0.00145***
	(0.000525)	(0.000498)	(0.000532)	(0.000513)
Delta CDS_Spread	-0.0412***	-0.0285***	-0.0417***	-0.0301***
	(0.0133)	(0.00850)	(0.0141)	(0.00876)
CDS Volatility	-3.528***	-2.569***	-2.198***	-1.532**
	(0.592)	(0.559)	(0.749)	(0.757)
Log Notional Amount	0.0488***	0.0322***	0.0497***	0.0321***
	(0.00559)	(0.00531)	(0.00616)	(0.00578)
N. of Trades	-0.000366***	-0.000262***	-0.000296***	-0.000108
	(0.00005)	(0.00005)	(0.00009)	(0.00008)
Delta VIX	-0.00477	-0.00241	0.0115*	0.00123
	(0.00629)	(0.00610)	(0.00693)	(0.00608)
Observations	2,515	2,006	2,515	2,006
Fixed Effects			M	M

Robust standard errors in parentheses: $***p < 0.01$, $**p < 0.05$, $*p < 0.1$.
Fixed effects: M=Month

Appendix A. Regulatory framework

The regulatory framework underlying the paper follows an agreement reached by G20 leaders in 2009 that aimed to move standardized over-the-counter (OTC) derivatives to central clearing and strengthen collateral and capital requirements for non-centrally cleared derivatives. The agreement came after the global financial crisis of 2007–2009 highlighted systemic weaknesses in the infrastructure of OTC derivative markets. The credit default swap (CDS) market in particular turned out to be characterized by highly concentrated and interconnected positions that served as conduits for the transmission of counterparties' failures to the rest of the financial system. Since then, regulators have advanced a number of reforms likely to affect the incentives for central clearing. To improve coordination, the OTC Derivatives Coordination Group was formed.[45]

The primary regulatory actions took place in the United States, where Congress in 2010 passed the Dodd-Frank Wall Street Reform and Consumer Protection Act, and Europe, where the European Parliament and the Council of Ministers in 2012 adopted the European Market Infrastructure Regulation (EMIR). Both reforms were designed to promote financial stability by improving accountability and transparency in the financial system. In the United States, the Securities and Exchange Commission and the Commodity Futures Trading Commission have been given authority to implement the Dodd-Frank Act, while in Europe, the European Securities and Markets Authority has been delegated the implementation of the EMIR.

In the Basel III framework (Bank for International Settlements, 2014a), banks' collateral and mark-to-market exposures to the central counterparties are subject to a lower risk weight than OTC exposures, while the default fund exposure to the counterparty credit risk is subject to capital requirements. The framework also includes requirements to exchange initial and variation margins for non-centrally cleared derivatives exposures.[46] In view of these regulatory changes, the OTC Derivatives Assessment Team at the Bank for

[45]The institutions that make up the OTC Derivatives Coordination Group are the Financial Stability Board, the Basel Committee on Banking Supervision, the Committee on the Global Financial System, the International Organization of Securities Commissions and the Committee on Payments and Market Infrastructures, previously known as the Committee on Payment and Settlement Systems.

[46]See "Margin Requirements for Non-Centrally Cleared Derivatives" (BCBS-IOSCO) and the "Principles for Financial Market Infrastructures" (CPMI-IOSCO).

International Settlements (BIS) carried out a study in 2014 to assess incentives to centrally clear OTC derivatives (Bank for International Settlements, 2014b). This survey identified margin costs and capital costs as the main drivers for the decision to clear and found that relevant incentives to clear centrally exist for CCP's clearing members, while they are less obvious for market participants that clear indirectly. Our paper aims to shed more light on these issues.

In 2017 the OTC Derivatives Coordination Group agreed to evaluate the impact of the G20 reforms on incentives to centrally clear OTC derivatives. The Derivative Assessment Trades Group at the Financial Stability Board conducted a study to understand whether G20 regulatory reforms achieved their intended outcomes. The report stressed the difficulties in identifying both the fraction of standardized OTC contracts eligible to clear and the total fraction centrally cleared; it documented a notable post-2009 increase in the number of contracts cleared for interest rate and credit derivatives.[47] Overall, the report indicates that more favorable regulation for cleared transactions combined with higher OTC transaction capital requirements would help incentivize banks to clear new trades. Our paper complements the Financial Stability Board's work and extends it along the following dimensions. First, our study is able to distinguish whether OTC derivatives contracts are eligible for clearing, therefore increasing the accuracy of the evidence on the extent of central clearing. Second, by focusing on certain asset derivative classes–sovereign CDS in our case–we are able to delve more deeply into the main drivers of the decision to clear a derivatives contract

Both the theoretical and empirical literature on central clearing has grown exponentially in recent years. The CDS market has received special attention, especially after ICE launched the first dedicated clearing house in March 2009. Before the global financial crisis, a few authors suggested that important public policy issues were whether and how to (i) encourage the use of CCP and (ii) standardize part of the OTC derivative market. Bliss and Steigerwald (2006) recognize that CCPs bring a bundle of interrelated services to the market, including credit risk management, delegated monitoring, and liquidity enhancement. The authors stress that one key advantage of

[47]The report shows that at the end of 2016, the central clearing rate of the stock of outstanding CDS was estimated to have reached 28% globally and 37% in the EU (Financial Stability Board, 2017).

CCPs is that credit risk becomes homogenized, at least as far as clearing members are concerned.[48]

In Europe, ESMA is the regulatory agency tasked with determining which types of derivatives contracts ought to be centrally cleared on a voluntary or mandatory basis. Eligibility depends on a number of factors: 1) sufficient activity, trading liquidity, and adequate pricing data; 2) a well-functioning infrastructure to support clearing; 3) the opportunity for systemic risk mitigation; 4) the impact on competition; and 5) the opportunity to resolve failures of the clearing house or clearing members with reasonable legal certainty. On top of these factors, CCPs may define other criteria for clearing eligibility for different types of instruments. As of December 31, 2013, 21% of all single-name reference entities were eligible for clearing (161 of 840 North American single-name reference entities and 121 of 493 European single-name reference entities),[49] according to Porter (2015), who examined the 250 largest North American single-name contracts and demonstrated that many CDS reference entities that were not eligible for clearing had characteristics that are similar to other reference entities that had been approved for clearing.[50]

[48]In a centrally cleared derivatives market, the clearing house typically sets the rules for the automatic netting and cancellation of offsetting contracts. Further, clearing derivatives through a CCP facilitates market liquidity. It allows, for instance, three different counterparties to exit the contracts without the need for a specific agreement among them and eliminates the credit risk of offset contracts. See Menkveld and Vuillemey (2021) for a detailed description of the regulatory and economic role of CCPs.

[49]A reference entity is the underlying legal entity upon which the CDS is based.

[50]See Porter (2015) available at `http://www.sec.gov/dera/staff-papers/white-papers/voluntary-clearing-activity.pdf`

Appendix B. Counterparty Credit Risk: A Numerical Example

In order to clarify the potential tradeoff in terms of counterparty credit risk (CCR) and capital requirements that dealers face when deciding whether to clear a transaction, we provide a simplified numerical example under three scenarios: a bilateral uncollateralized transaction, a bilateral collateralized transaction under a credit support annex (CSA) agreement, and a centrally cleared transaction.[51]

The relevant regulatory rules to calculate the capital requirements for counterparty risk are included in Regulation (EU) No 575/2013 of the European Parliament and of the Council of 26 June 2013 on prudential requirements for credit institutions and amending Regulation (EU) No 648/2012 (CRR).[52] More specifically, the following variables are relevant for the calculation of CCR under the simplified standardized approach (Article 281).

$$\text{Exposure value} = \alpha \cdot (RC + PFE) \tag{B.1}$$

where RC represents the replacement cost and PFE the potential future exposures (Article 274). The constant α is fixed at 1.4 in the rule text. Both RC and PFE are calculated differently if a) the transaction is centrally cleared or if the collateral is exchanged bilaterally, or b) if there are no margins and collateral exchanged. In case a), RC is calculated as follows:

$$RC = TH + MTA \tag{B.2}$$

where TH is the margin threshold applicable under the margin agreement below (which the institution cannot call for collateral), and MTA is the minimum transfer amount under the margin agreement. In the uncollateralized case b), RC is calculated as follows:

$$RC = max\{CMV, 0\} \tag{B.3}$$

where CMV represents the current market value of the CDS. As to the PFE (potential future exposures), the value is calculated as follows:

[51] We thank an anonymous referee for this suggestion.

[52] The latest consolidated text is available at https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02013R0575-20220708.

$$PFE = \sum_{a} AddOn^{(a)} \tag{B.4}$$

where $AddOn^{(a)}$ refers to the add-on for risk category a. For a CDS, the $AddOn$ depends on the creditworthiness of the reference entity. For instance, a CDS written on a BBB sovereign would have an $AddOn$ equal to 0.54% (Credit quality step 3), while the $AddOn$ for an AAA would be equal to 0.38%. Finally, to calculate the risk position (Article 279) for $AddOn$, the value is calculated as follows:

$$RiskPosition = \delta \cdot AdjNot \cdot MF \tag{B.5}$$

where δ is the supervisory delta (+1 for long positions, -1 for short positions), $AdjNot$ is the adjustment notional, and MF is the maturity factor. For simplicity, we do not assume any adjustment of the notional amount, such that $AdjNot = Notional$. As to the maturity factor (Article 281), for unmargined OTC transactions, $MF = 1$, while for cleared transactions and transactions where the collateral is exchanged, $MF = 0.42$. Finally, to calculate the risk-weighted exposure amount, the exposure value is multiplied by the applicable risk weight, which is equal to 20% for bilateral OTC transactions (with or without collateral), and by 2% for centrally cleared transactions.

To wrap up the calculation, the exposure values for uncollateralized and collateralized/cleared transactions are calculated as follows:

$$\text{Exposure value uncollaterialized} = \alpha \cdot [max\{CMV, 0\} + (\delta \cdot Notional \cdot RemainingMaturity \cdot MF \cdot AddOn)] \tag{B.6}$$

$$\text{Exposure value collaterialized} = \alpha \cdot [TH + MTA + (\delta \cdot Notional \cdot RemainingMaturity \cdot MF \cdot AddOn)] \tag{B.7}$$

These exposures, as noted above, will be multiplied by the relevant risk weights. One additional simplification is that we do not assume any additional counterparty risk coming from margin posting (margins are in custody in a segregated bankruptcy-remote account).

We consider two examples. The first is where a German bank sells to a US bank a five-year CDS written on Italy (IT) as reference entity. The CDS has the following features:

Notional = EUR 100 million; Maturity = 5 years; RemainingMaturity = 2.5 years; Annual premium (paid by the US bank) = EUR 1.4 million; CMV = EUR 0.4 million; MTA = EUR 0.02 million; TH = EUR 0.02 million; AddOn = 0.54% (BBB).

As Table B.10 shows, compared to centrally cleared transactions, bilateral OTC transactions do not imply any clearing costs (e.g. contribution to the CCP default funds or other clearing fees) and, in case of uncollateralized transactions, do not require the posting of margins. On the other hand, the risk weights for capital requirements and the consequent risk-weighted exposure amount, are larger. Moreover, netting opportunities (which are not explicitly modelled in our example) tend to be lower, because only transactions between the same counterparties can be netted.

As the results of our calculations show, the raw exposure value in terms of CCR is the same for fully collateralized bilateral trades under CSA agreement and for centrally cleared trades. Under a two-way CSA agreement, both transactions (CCP and OTC) require posting collateral and subsequent margin calls based on mark-to-market valuations. According to current regulations, when considering a single transaction, the calculation of the resulting exposure arising from a collateralized OTC exposure under a CSA agreement in CDS is the same as in a cleared transaction (See Article 54.8 of the Basel III Framework). However, there are important differences in terms of risk-weighted exposures and hence capital requirements. In fact, the lower risk weight applied to cleared transactions, in fact, substantially reduces the final risk-weighted exposure, creating incentives to clear a transaction in order to reduce CCR capital charges. As our results indicate, the uncollateralized OTC transactions are even more costly in terms of CCR, so the incentives to clear the transaction in order to reduce CCR capital charges are even higher. However, these benefits (in terms of lower capital charges) would need to be weighted against the fact that uncollateralized OTC transactions, unlike collateralized OTC transactions under CSA, do not imply the posting of any margin requirements.

A comparison between CDS buyer and CDS seller shows that the benefit of central clearance is even more important for a buyer than for a seller because both the exposure value and the risk-weighted exposure are larger for the buyer than for the seller in a bilateral OTC transaction. Instead, because the counterparty risk is mitigated by central clearance, there are no differences between buyers and sellers in terms of exposure value and risk-weighted exposure amount.

As a second example, we consider a Dutch bank that sells a five-year CDS to a US bank written on Germany (DE) as reference entity. The CDS has the following features: Notional = EUR 100 million; Maturity = 5 years; RemainingMaturity = 2.5 years; Annual premium (paid by the US bank) = EUR 0.17 million; CMV = EUR 0.03 million; MTA = EUR 0.01 million; TH = EUR 0.01 million; AddOn = 0.38% (AAA).

As Table B.11 shows, the exposure value and the risk-weighted exposure amount are lower for the CDS on DE compared to the one on IT. In relative terms, the differences between a bilateral OTC contract and a centrally cleared contract are also lower, reducing the incentives to clear the contract, ceteris paribus.

An aspect we did not explicitly consider in our examples is the riskiness of the counterparty. Indeed, a significant consideration for (mostly) purchasers of protection in the CDS market may be the credit quality of the protection seller, which may itself go bankrupt either before or at the same time as the reference entity. This aspect could be captured, for example, in our second case by considering the case of a riskier Italian bank selling to the US bank the five-year CDS written on DE as reference entity. In this case, the exposure value for both buyer and seller would be the same. The main difference would be the risk weights applicable to the seller, which would remain the same (2%) for a centrally cleared transaction, while they might change (from 20%) for the bilateral OTC transaction depending on the credit risk approach applied by the US bank. If the US bank uses internal ratings or counterparty ratings, the risk weight applicable to the seller would be higher, increasing the risk-weighted exposure amount and hence the incentive to clear.

Table B.10: **Example 1**
A German bank sells a five-year credit default swap written on Italy as reference entity to a US bank. The credit default swap has the following features: Notional = EUR 100 million; Maturity = 5 years; RemainingMaturity = 2.5 years; Annual premium (paid by the US bank) = EUR 1.4 million; CMV = EUR 0.4 million; MTA = EUR 0.02 million; TH = EUR 0.02 million; AddOn = 0.54% (BBB).

Seller	**Centrally cleared**	**Bilateral OTC (CSA with margins)**	**Bilateral OTC (uncollateralized)**
Cash flows	Receiving: Annual premium	Receiving: Annual premium	Receiving: Annual premium
	Paying: Margin posting (if required) and exposure at default (if occurring), plus other clearing costs (e.g., clearing fees, contribution to the CCP default fund)	Paying: Margin posting (if required) and exposure at default (if occurring)	Paying: Exposure at default (if occurring)
Credit risk mitigation	Margining and protection through the CCP	Margining (if posted)	No mitigation
Netting opportunities	Netting sets permitted: Advantage through larger netting sets, depending on the number of transactions and directionality of portfolios)	Netting sets permitted	Netting sets permitted
Exposure value (counterparty risk)	0.822	0.822	1.890
Applicable risk weight	2%	20%	20%
Risk-weighted exposure Amount	0.016	0.164	0.378
Buyer			
Cash flows	Receiving: Exposure at default (if occurring)	Receiving: Exposure at default (if occurring)	Receiving: Exposure at default (if occurring)
	Paying: Annual premium and margin posting plus other clearing costs (e.g., clearing fees, contribution to the CCP default fund)	Paying: Annual premium and margin posting (if required)	Paying: Annual premium
Credit risk mitigation	Margining and protection through CCP	Margining (if posted)	No mitigation
Netting opportunities	Netting sets permitted: Advantage through larger netting sets, depending on the number of transactions and directionality of portfolios)	Netting sets permitted	Netting sets permitted
Exposure value (counterparty risk)	0.822	0.822	2.450
Applicable risk weight	2%	20%	20%
Risk-weighted exposure amount	0.016	0.164	0.490

Table B.11: **Example 2**
A Dutch bank sells a five-year credit default swap written on Germany as reference entity to a US bank. The credit default swap has the following features: Notional = EUR 100 million; Maturity = 5 years; RemainingMaturity = 2.5 years; Annual premium (paid by the US bank) = EUR 0.17 million; CMV = EUR 0.03 million; MTA = EUR 0.01 million; TH = EUR 0.01 million; AddOn = 0.38% (AAA).

Seller	**Centrally cleared**	**Bilateral OTC (CSA with margins)**	**Bilateral OTC (uncollateralized)**
Cash flows	Receiving: annual premium Paying: margin posting (if required) and exposure at default (if occurring), plus other clearing costs (e.g. clearing fees, contribution to the CCP default fund)	Receiving: annual premium Paying: margin posting (if required) and exposure at default (if occurring)	Receiving: annual premium Paying: exposure at default (if occurring)
Credit risk mitigation	Margining and protection through the CCP	Margining (if posted)	No mitigation
Netting opportunities	Netting sets permitted, advantage through larger netting sets, depending on the number of transactions and directionality of portfolios)	Netting sets permitted	Netting sets permitted
Exposure value (counterparty risk)	0.587	0.587	1.330
Applicable risk weight	2%	20%	20%
Risk-weighted exposure amount	0.012	0.117	0.266

Buyer			
Cash flows	Receiving: exposure at default (if occurring) Paying: annual premium and margin posting plus other clearing costs (e.g. clearing fees, contribution to the CCP default fund)	Receiving: exposure at default (if occurring) Paying: annual premium and margin posting (if required)	Receiving: exposure at default (if occurring) Paying: annual premium
Credit risk mitigation	Margining and protection through the CCP	Margining (if posted)	No mitigation
Netting opportunities	Netting sets permitted, advantage through larger netting sets, depending on the number of transactions and directionality of portfolios)	Netting sets permitted	Netting sets permitted
Exposure value (counterparty risk)	0.587	0.587	1.372
Applicable risk weight	2%	20%	20%
Risk-weighted exposure amount	0.012	0.117	0.274

Appendix C. Database Description and Cleaning Procedures procedures

The entire database comprises all derivative classes (such as credit, commodity, equity, interest rate, and foreign exchange). Six different TRs provide data to ESMA and ESRB.[53] In general, those TRs provide two types of data: a mandatory report called "trade activity" that contains all new trades, modifications, and cancellations; and a second set of data called "trade state" and that contains outstanding positions up to a certain date. We use the trade activity dataset for the daily analysis, which we focus analysis on a subset of sovereign CDS: the reference entities are IT, DE, and France(FR).

We briefly summarize the data cleaning procedure, referring to the aforementioned papers for more details. In order to extract the correct reference entities for the DE,FR, and IT CDS contracts, we first retrieve all unique underlying codes from the EMIR data. A formal distinction between sectors is not present in the reporting mandatory fields, so we use different data providers to classify the reference entities. We use the International Securities Identification Numbers (ISIN) codes of sovereign bonds auctioned in the last 10 years as a first source. We complement the auction data with the ECB-CSDB data, Datastream, the list of eligible ISINs from ICE Clear Credit, and the list of RED6 codes from Markit. Our broad list of underlying securities contains 8858 unique identifiers, of which roughly 2,000 are related to sovereign debt and the remainder to public entities owned by governments that are also categorized as sovereign by the data providers. We ignore the latter group, while we extract from the raw daily files the trades related to the first group for both the OTC and the Exchange-Traded-Derivative repositories.

EMIR regulations require that both counterparties report the trade to one of the authorized TRs; this is known as the "double-reporting" obligation. Thus, if a trade involves two EU counterparties, we find both records in the database; when one counterparty is not in the EU, we find only one record. We unambiguously identify these two sets of transactions: the unique observations that cannot be matched, and the two observations reported by the EU counterparties– and keep track of them. A specific flag called "action type" allows us to partially track changes in the contract, (e.g. notional amount, upfront payment, spread). There are three timestamps reported for

[53]The six TR are CME, DTCC, ICE, KDPW, Regis-TR and UnaVista.

each transaction: the *reporting timestamp*, which refers to the moment when the counterparty communicates the trade to the TR; the *execution timestamp*, which indicates the moment when the transaction takes place; and (for some trades) the *confirmation timestamp*. We first drop exact duplicates and observations where information regarding spread (price), notional, and upfront[54] is all missing. Then, to be as conservative as possible, in the case of duplicate observations, we try to assess the quality of one of the two and possibly integrate the missing values of one with the other.[55]

Appendix D. Descriptive statistics

Table D.12 describes the transactions reported in the EMIR database of the three sovereign CDS; more specifically, the gross and net notional amounts and the number of counterparties, classified by market participant type. The counterparty categories reported in the database are banks, dealers, funds, other institutions, and others. The category dealers includes the 16 largest dealers identified by Abad et al. (2016).[56] The category other institutions category includes insurance companies, pension funds, and nonfinancial organizations, while the others category includes all non-classifiable institutions. As Table D.12 shows, the gross notional amount traded in 2016 and reported in the EMIR database is $US797B. The dealers are the most active with $576B of gross notional amount (74.8% of the total gross notional amount) followed by banks ($96B) and funds ($95B) with 12.01% and 11.92%, respectively. The other two categories, other Institutions and others, account for $7.72B and $2.19B, respectively, or 0.97% and 0.27% of the total gross notional. These numbers are in line with the evidence provided by earlier studies like Getmansky et al. (2016), Peltonen et al. (2014), and Abad et al. (2016), which confirms that the CDS market is highly concentrated around a small number of counterparties and that this concentration

[54]When the contract is standardized, the difference of cash called upfront is added. For sovereign CDS, the fixed coupon is 25 or 100 basis points [bps].

[55]For some trades, the CDS spread is directly reported, while for others only an indication of the coupon is provided. We keep all observations even if the price is sometimes not reported or not reliable. We prefer to avoid the use of the reported transaction price in our analysis because of a lack of reliability and misreporting issues.

[56]Bank of America, Barclays, BNP Paribas, Citigroup, Crédit Agricole, Credit Suisse, Deutsche Bank, Goldman Sachs, HSBC, JPMorgan Chase, Morgan Stanley, Nomura, Royal Bank of Scotland, Société Générale, UBS, and Wells Fargo.

is a persistent feature.[57]

Regarding the net notional amount, the difference between the amount bought and sold during 2016, panel A of Table D.12, shows that the dealers category presents a net exposure lower than the funds and banks categories, at \$3.70B versus \$7.22B and \$5.54B, respectively. Moreover, dealers in 2016 represent a positive net amount: that is, they were net buyers of CDS protections for transactions in that year. Meanwhile, funds and other institutions were the largest net sellers of protection. Among the 16 dealers, the analysis shows that only 15 were active in the sovereign CDS markets of IT, FR, and DE. Among the non-dealers, 33 are banks, 233 are funds, 40 are other institutions like insurance companies and pension funds, and 123 are institutions whose type cannot be identified.

In the previous section, we highlighted the peculiarities of clearing members versus non-clearing members and the differences in the incentives to clear for institutions that are subject to CCR capital requirements versus those that are not. In our dataset, all dealers are clearing members, and the other 11 clearing members are all banks;[58] hence, all clearing members are subject to capital requirements. For this reason, we report in Panel B the same information in Panel A, with the distinction between clearing members and all other institutions that are not clearing members, distinguishing among those that are subject to capital requirements and those that are not.[59]

Table D.12 Panel B shows that clearing members are responsible for the largest fraction of contracts, with roughly 96% of the gross notional amount, considering both cleared and not-cleared contracts. The clearing members have a positive net notional amount of \$9.7B versus the negative total net no-

[57]This evidence is also confirmed for the US corporate CDS market by Brunnermeier et al. (2013).

[58]We define the set of clearing members according to the legal entity identifier membership list provided by ICE (`https://www.theice.com/index`). However, the same ultimate global owner could employ different identifiers that fall into the categories of dealer, bank, or fund. Panel A of Table D.12, classifies each market participant according to legal entity identifier, while Panel B of Table D.12 takes into account the clearing membership as determined by ICE. For that reason, a legal entity identifier whose ultimate global owner is a dealer or a bank falls into the category of funds in Panel A, but is a clearing member in Panel B.

[59]The motivation behind this classification is that institutions subject to capital requirements could have additional advantages to clear derivatives transactions because of the reduction in the amount of capital requirements that clearing provides.

Table D.12: **Notional Amounts and Number of Counterparties by Type of Market Participant**
For both panels, we report the gross notional amount both in billions of US dollars and as percentages, the net notional amount, and the number of counterparties for each market participant category. Panel A shows the data by the market participant type. The other institutions category includes Insurance companies, pension funds, and non-financial organizations. The others category contains all other non-classifiable institutions. Panel B shows the data by institutions grouped into categories: Non-Clearing Members (CR) are the non-clearing members institutions subject to capital requirements, Non-Clearing Members (NCR) are the non-clearing member institutions not subject to capital requirements, while others holds all the other non-classifiable institutions. The data come from TRs under the EMIR reporting requirement for the year 2016.

Panel A

Market Participants	Gross Notional Amount (US$B)	Gross Notional Amount (%)	Net Notional Amount (US$B)	Number of Counterparties
Banks	95.8	12.0%	5.5	33
Dealers	596.6	74.8%	3.7	15
Funds	95.1	11.9%	-7.2	233
Other Institutions	7.7	1.0%	-2.1	40
Others	2.2	0.3%	0.02	119

Panel B

Market Participants	Gross Notional Amount (US$B)	Gross Notional Amount (%)	Net Notional Amount (US$B)	Number of Counterparties
Clearing Members	769.1	96.5%	9.7	26
Non-Clearing Members (CR)	8.5	1.1%	-2.2	29
Non-Clearing Members (NCR)	17.1	2.1%	-8.1	266
Others	2.6	0.3%	-0.02	123

tional amount of \$−10.3B for non-clearing members (\$−2.2B and \$−8.1B, for those subject and not subject to capital requirements, respectively). Among non-clearing members, a large fraction of the transactions are performed by traders not subject to capital requirements: 2.1% of the total gross notional amount corresponding to a gross exposure of \$17.1B. This group is formed by the largest number of counterparties (266) and has the largest net notional exposure (\$−8.1B). The group of non-clearing members subject to capital requirements, meanwhile, is comprised of only 29 counterparties.

According to ICE,[60] a single-name sovereign CDS reference entity can be cleared according to the following criteria:

- The contracts must be in USD and may be cleared to either ICE Clear Credit or ICE Clear Europe;
- For ICE Clear Credit, the restructuring clauses applicable are CR, CR14, MR, and MR14. For ICE Clear Europe, they are CR and CR14[61];
- The fixed interest rate on the contract is either 25 or 100 bps for the three sovereign reference entities selected;
- The tenor of the contract is less than 10 years;
- The reference obligations are SNRFOR Tier (Senior Debt).

The BIS statistics[62] report that \$1.7 trillion of gross notional single-name CDS on sovereign bonds were outstanding at the end of the year 2016, with \$551B of this amount was cleared. The Financial Stability Board (2017) report indicates that clearing rates for the flow of new transactions in OTC credit derivatives (both corporate and sovereign) as a whole were estimated at 37% in the EU and in index CDS at 80% in the US. Fig. D.1 shows the ratio between the gross notional amount of outstanding CDS contracts on sovereign bonds cleared over the total gross notional amount of outstanding

[60] see https://www.theice.com/clearing. The ICE criteria are applied in the study to define eligibility for clearing.

[61] In addition, both ISDA 2003 and ISDA 2014 credit derivatives definitions can be cleared on both CCPs. The IT CDS can be cleared on both CCPs, while DE and FR CDS are only accepted by ICE Clear Credit.

[62] Data from BIS: https://stats.bis.org/statx/srs/table/d10.4

CDS contracts on sovereign bonds. The ratio starts near zero at the beginning of 2010 and increases to 32% for the single-name sovereign CDS and to 19% for the multi-name index sovereign CDS at the end of 2016. The ratio stabilizes above 40% for single names and between around 20% and 30% for multi-names as of mid-2021.

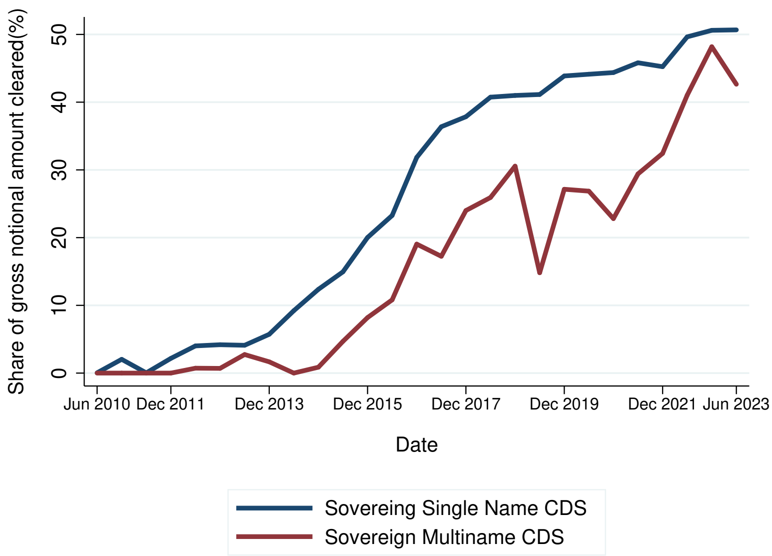

Figure D.1: **Share of Cleared Sovereign CDS Contracts of Gross Notional Amount**
The figure shows the ratio between the gross notional amount cleared and the total gross notional amount for single-name sovereign CDS and multi-name sovereign CDS contracts. The ratio is calculated starting from the semi-annual open positions with a sample from June 2010 to June 2023. The source of data is the BIS OTC derivatives statistics database, available at https://stats.bis.org/statx/srs/table/d10.4

In our analysis, we investigate the share of clearing versus not clearing of the three selected sovereign CDS contracts. Unlike the statistics reported by the BIS and the Financial Stability Board, we also report the percentages of contracts that are eligible to clear but are not cleared, as well as those that are not eligible for clearance because they are not standard contracts accepted by the clearing houses. This information is crucial because it already provides an idea of whether the contracts that are not cleared could not be cleared because they are not standard or because traders chose not to clear them.

Fig. D.2 reports the percentage of the gross amount cleared, the percentage eligible for clearing, and the percentage not eligible for clearing. The first bar of Fig. D.2 shows the percentages for all samples and indicates that the gross notional amount cleared is 48%, the share of contracts not cleared but eligible for clearing is 43%, and the share of non-clearable contracts is 9%, respectively.

The most common reasons why a contract is not eligible for clearing are as follows: the currency of the contract is Euro (89.21%), the tenor is longer than 10 years (10.41%), and the remaining (0.38%) are securities (ISINs) not accepted by the clearing house for a specific reference entity. There is in fact a growing trend toward clearance, as the clearing rate of 48% of the flow of new contracts in the sample is larger than the clearing rate of the stock of contracts reported by the BIS statistical reports (see Fig. D.1 at the end of 2016). The percentage is also larger than the fraction of the flows of cleared contracts reported by the Financial Stability Board (2017), indicating that central clearing is more pervasive among sovereign CDS reference entities than among corporates.[63]

The second bar in Fig. D.2 shows the percentage of gross notional amount cleared, not cleared but eligible for clearing, and not clearable for contracts where both counterparties are clearing members. The fraction of cleared contracts among clearing members is larger than that of non-cleared contracts (68% vs. 31%). Non-eligible contracts make-up 5%; therefore, among clearable contracts, 72% of the gross notional amount was cleared (0.68/0.95). This implies that there are significant incentives for clearing members to clear even if clearance of single-name CDS contracts has not yet been made mandatory.

The last bar in Fig. D.2 shows the percentages of cleared and non-cleared contracts where at least one of the two counterparties is a non-clearing mem-

[63]This analysis might potentially overestimate the actual volume of the cleared transactions because it is sometimes impossible to match the two legs of a given contract. For instance, we observe only one leg of a contract when it is cleared, when one of the counterparties is not regulated by the EU, or when the transaction is cleared through a US CCP.

ber. In this case, the percentage of the notional amount cleared is close to zero (0.05%)[64], which is not remotely comparable to the clearance fraction of clearing members (53%). The lack of incentives for non-clearing members to clear contracts through the CCP is likely due to a combination of factors, including expenses such as CCP default fund charges and clearing fees that may be deemed too costly to make clearing worthwhile. There are also noticeable differences between non-clearing members and clearing members in the fraction of transactions not eligible to be cleared: about 20% of the gross notional amount for non-clearing members versus 8% for clearing members.

Since one of the incentives to clear is the reduction of capital costs through lower capital requirements, Figure D.3 reports the percentage of cleared versus clearable contracts, distinguishing between non-clearing members that either are (CR) or are not (NCR) subject to capital requirements.

Fig. D.3 shows that independent of capital requirement restrictions, the percentage of notional amount cleared by non-clearing members is practically zero for those subject to capital requirements and very low (0.09%) for those not subject to capital requirements. This indicates that there are no significant incentives for non-clearing members to clear a contract with the CCP, with no distinction between institutions that are and are not subject to capital requirements. The figure also shows a distinction between the types of non-clearing members regarding the fraction of contracts eligible to clear. For non-clearing members subject to capital requirements, this fraction is about 75%, while for non-clearing members not subject to capital requirements is 85%. This means that a larger fraction of contracts for non-clearing members subject to capital requirements are bespoke contracts (25%), potentially tailored to specific clients needs (this category includes banks and insurance companies). Taken together, Fig. D.2 and Fig. D.3 show the dichotomy in the behaviour of clearing members versus non-clearing members in the decision to clear and the characteristics of the contracts into which these different categories of counterparties enter.

The histogram in Fig. D.4 shows the distribution of sovereign CDS contracts' tenor in our sample. The figure shows that most of the activity is concentrated in the five-year bucket, which covers around 30% of the total

[64]This estimate is likely to be a lower bound of the true amount of clearing activity of non-clearing members due to the fact that a portion of their trades cleared through omnibus client accounts may be attributed in our dataset to the clearing members instead of their clients.

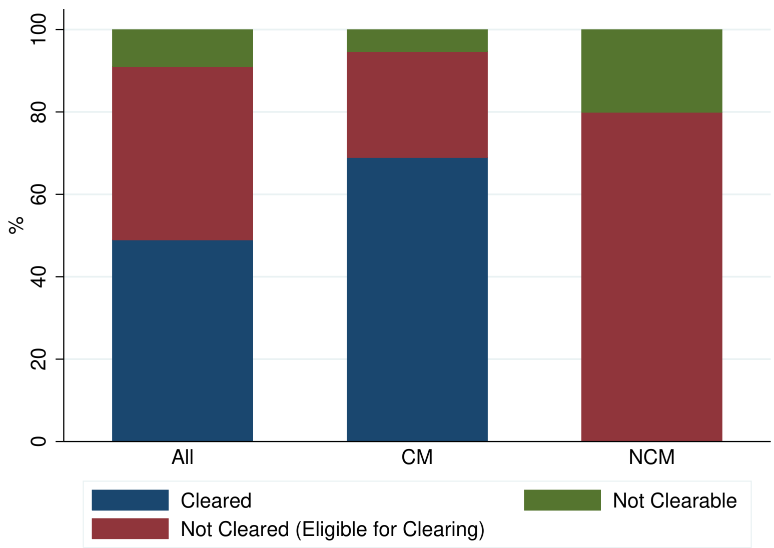

Figure D.2: **Clearing of Sovereign CDS Contracts by Counterparty Type**
The figure shows the share of gross notional amount traded in our sample, classifying each trade under the following categories: cleared, not cleared, and not eligible for clearing, as described in Section Appendix D. The first bar includes all contracts traded in our sample, the second bar includes only the contracts where both counterparties are clearing members, and the third bar includes the contracts where only one counterparty is a clearing member. The sample is composed of single-name sovereign CDS contracts written on IT,DE, and FR as reference entities in 2016. The data come from TRs under the EMIR reporting requirement.

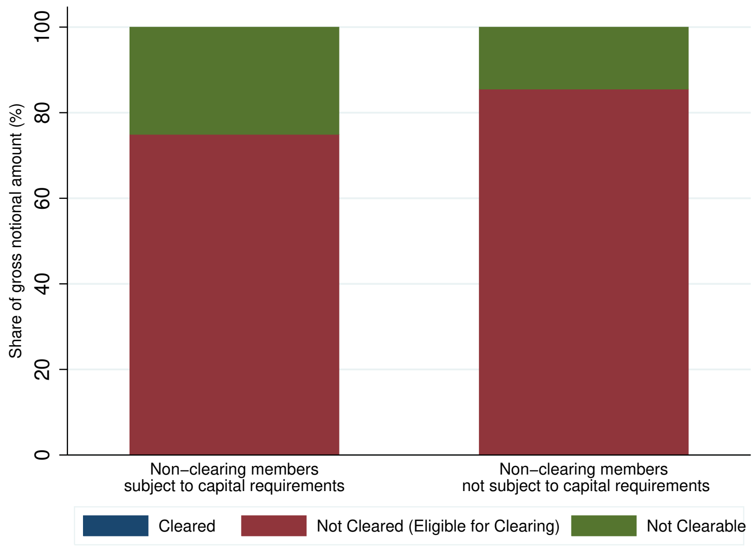

Figure D.3: **Central Clearing Eligibility, Client Clearing, and Capital Requirements**
The figure shows the share of gross notional amount traded in our sample, including only the trades where only one counterparty is a clearing member. We classify each trade under the following categories: cleared, not cleared, and not eligible for clearing, as described in Section Appendix D. The first bar includes all contracts where the non-clearing member is subject to capital requirements, and the second bar includes all contracts where the non-clearing member is not subject to capital requirements. The sample is composed of single-name sovereign CDS contracts written on IT, DE, and FR as reference entities in 2016. The data come from TRs under the EMIR reporting requirement.

notional amount traded. More generally, 82% of the activity in our sample is concentrated in contracts with a maturity of less than or equal to five years. For short-term contracts – those with a tenor of less than one year – the percentage is very small, at around 2%.

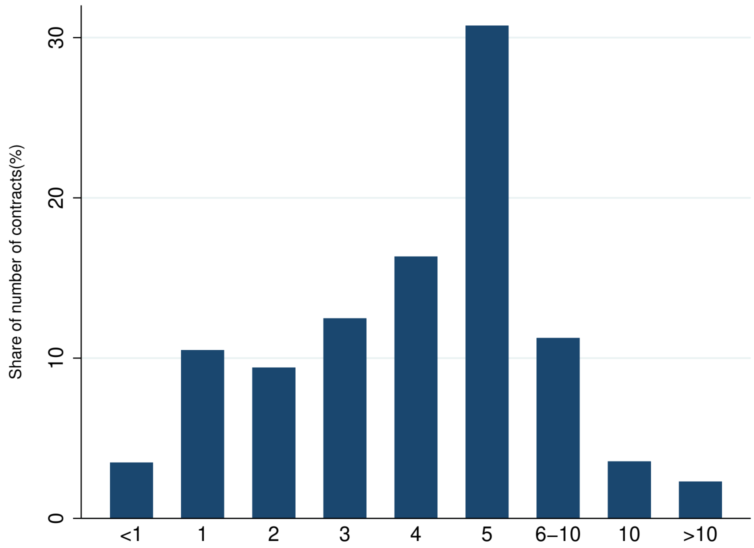

Figure D.4: **Distribution of Sovereign CDS Contracts' Tenor**
The figure shows the relative frequency of CDS transactions grouped by buckets of tenors. The sample is composed of single-name sovereign CDS contracts written on IT, DE, and FR as reference entities in 2016. The data come from TRs under the EMIR reporting requirement.

Finally, Fig. D.5 displays the share of the gross amount traded for each of the three reference entities considered: DE, FR, and IT. The most traded contract is the IT CDS with 68% of the total amount traded in 2016, followed by FR at 19%, and DE at around 15%. The ranking of trading activity of these three sovereign CDS contracts follows that of their CDS premia.

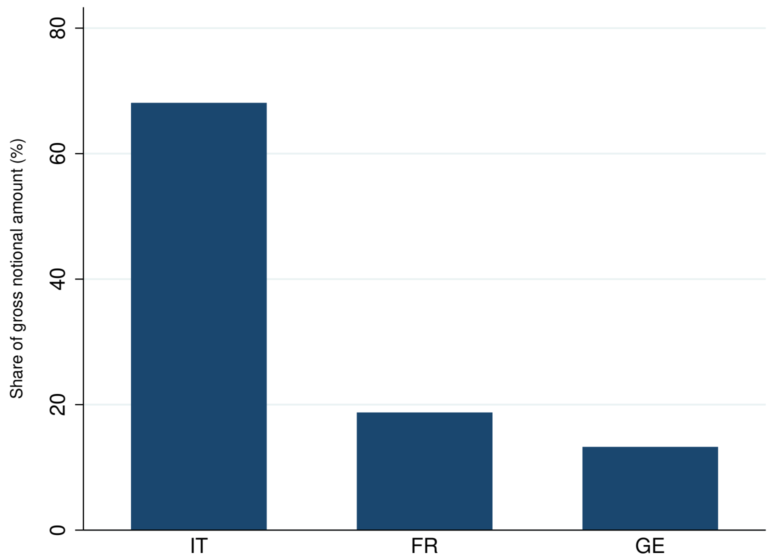

Figure D.5: **Share of the Gross Notional Amount Traded**
The figure shows the share of the total gross notional amount traded for each of the three sovereign CDS reference entities included in our sample. The sample is composed of single-name sovereign CDS contracts written on IT, DE, and FR as reference entities in 2016. The data come from TRs under the EMIR reporting requirement.