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

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Abstract

This paper is a first attempt at empirically analyzing whether post-crisis regulatory reforms developed by global-standard-setting bodies have created appropriate incentives to centrally clear Over-The-Counter (OTC) derivative contracts. We analyze three main drivers of the decision to clear: 1) the credit risk of the counterparty; 2) the characteristics of the contract; 3) the clearing member's net exposure vis-a-vis the Central Counterparty Clearing House (CCP). We use confidential European trade repository data on single-name sovereign Credit Derivative Swap (CDS) transactions, and show that both the seller and the buyer manage counterparty's exposures and capital costs, strategically choosing to clear when the counterparty is riskier. The riskiness of the underlying reference entity also enters the decision to clear as it affects both Counterparty Credit Risk (CCR) capital charges for OTC contracts and CCP margins for cleared contracts. We empirically investigate the trade-off between the two and find that the likelihood to clear is higher if the reference entity becomes more risky, but only for the riskier sovereign CDS in the sample, while for safer sovereign CDS the opposite is true. Our findings suggest that CCP margin 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. Lastly, we find some evidence that when the transaction helps reducing counterparty's overall outstanding positions (and therefore margins) vis-a-vis the CCP, the likelihood to clear is higher. This result holds true as long as considerations such as CCR counterparty risk and wrong-way risk do not prevail.

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

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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 with the objectives 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; and 5) standardized OTC derivatives should be traded on exchanges or electronic trading platforms, where appropriate.[1] The U.S. Congress signed 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.

While in Europe and in the US credit default swap (CDS) indices must be cleared under the MiFID regulation,[2] a rule for single name CDS reference entities has not yet been finalized. As a result, the decision to clear single name CDS is still voluntary to date. From the BIS reports[3] one can deduce 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 fraction is increasing over time.[4] While there is not yet a regulatory obligation to clear single-name contracts in the EU and in the US, therefore, there appear to be economic incentives to do so.[5]

[1] See the 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 over-the-counter (OTC) derivatives statistics database, available at http://stats.bis.org/statx/srs/table/d10.4?p=20162&c=.

[4] This figure ignores criteria regarding whether a contract has been accepted for clearing or otherwise is sufficiently standardized as to be clearable. Porter (2015) reports that a majority of contracts on U.S. reference entities that are accepted for clearing is in fact being cleared.

[5] Although there is not a formal rule on-point, for several years major dealers have operated under a com-

The research question of this paper is why only some sovereign CDS transactions currently eligible for central clearing are cleared while others are not. We investigate this from a clearing member perspective and focus on what are the drivers of this decision by considering factors impacting capital and collateral costs.[6] We analyze empirically the relevance of these different drivers in the decision to clear by using a unique regulatory dataset: the confidential European trade repository data on single-name sovereign CDS transactions ruled by the EMIR. The database used for our analysis includes CDS traded in 2016 in which at least one of the two counterparties was a EU financial institution. Our analysis focuses on the most traded European sovereign CDS contracts: Italy (IT), France (FR) and Germany (GE). We concentrate on these three sovereign CDS as they are among the contracts mostly 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, our paper is the first to investigates empirically the fraction of eligible contracts for clearing and the drivers of the decision to clear a contract. We find that in our sample about 48% of the notional amount traded in 2016 has been cleared, 42% was not cleared despite being eligible for central clearing, while 9% was not clearable because the contracts did not satisfy certain Central Counterparty Clearing house (CCP) clearing criteria.

In our sample we notice a stark differentiation in the decision to clear between clearing members and non-clearing members. Clearing members account for 96.5% of the gross notional amount traded, and are net buyers for an aggregate 9.7 billion US dollars, a size comparable to net selling position of non-clearing members that are not subject to capital

mitment to the New York Fed to use CCPs. See letter to William Dudley, President, Federal Reserve Bank of New York and accompanying credit default swap appendix discussing commitment to increase the usage of central counterparties to âĂIJsignificantly reduce the systemic risk profileâĂİ of the over-the-counter derivatives market, with each G15 member individually committing by October 2009 to submit 95 percent of credit defaults swap trades with other G15 counterparties when both have a clearing relationship in place with a central counterparty. (June 2, 2009)(https://www.newyorkfed.org/newsevents/news/markets/2009/ma090908)

[6]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, instead, reflects the incremental costs of borrowing cash to acquire eligible collateral.

requirements (-8.1 B$). 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 insurances — and those not) we observe instead that the fraction of clearing activity is close to zero.[7] The lack of clearing activity of non clearing members may be due to several reasons. First, non-clearing members not subject to capital requirements may have little incentive for central clearing because the absence of capital costs make bilateral trading a relatively cheaper option. Second, all non-clearing members (both those subject to capital requirements and those not) may deem expenses such as CCP default funds charges and clearing fees too costly. Third, when compared to the trading strategy of clearing members, non-clearing members portfolios are typically more directional and concentrated across a few brokerage firms; this means that the benefits derived from multilateral netting by CCP will be less pronounced and incentives to clear centrally will be relatively weaker.[8]

We investigate the drivers of the decision to clear by looking at different characteristics of the transaction that could capture differences in terms of capital and margin costs between cleared and not cleared contracts. Concerning collateral requirements, one key aspect is the existing disparity between initial and variation margins among cleared and non cleared contracts. For the most part, margins are not exchanged or are lower in the OTC transactions (at least until the new margin requirements for OTC derivatives take effect)[9], while they are required by CCPs for cleared trades. On the other side, Counterparty Credit Risk (CCR) capital charges introduced by Basel III are larger for non cleared transactions (net of collat-

[7]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.

[8]Clearing members tend to have overall flat books when aggregating exposures across counterparties. Non-clearing members, instead, tend to have overall directional exposures and interact with a much smaller number of counterparties; moving clearing-eligible trades from bilateral counterparties to a single CCP may therefore not reduce significantly their overall exposures.

[9]Regulatory requirements have been changed from January 2017 onwards and now initial, and variation margins are mandatory to collect also for the OTC derivative transactions (see the Commission Delegated Regulation (EU) 2016/2251 of October 4, 2016). Our analysis covers transactions up to 2016, a period in which significant differences between margin requirements of cleared and non-cleared contracts existed.

eral collected from bilateral counterparties) than for centrally cleared trades.[10] This should provide a relevant incentive to clear, at least for institutions subject to capital requirements. It is worth noticing that from a clearing member's risk management perspective the reduction of a large counterparty credit risk exposure may provide a relevant incentive to clear the contract in and of itself, independently from the favorable treatment that the cleared transaction would have in terms of capital requirements. Since the two aspects go hand in hand and we can not differentiate them, throughout the paper, we refer to a reduction in capital costs and to a reduction in counterparty credit risk exposure interchangeably [11].

We model the clearing members' incentives to clear a contract based on the (i) riskiness of the counterparty (ii) and the characteristics of the contract that affect both the margin setting by CCPs and CCR capital requirements. In principle, riskier contracts could encourage clearing in order to reduce CCR capital requirements, but on the other side, riskier contracts entail larger margins with the CCP. Only by investigating this issue empirically we can disentangle which element prevails. One additional aspect that should be considered when modeling the decision to clear relates to the individual incentives each firm faces vis-a-vis its outstanding exposures with the CCP and the counterparty of the trade. In principle, trades that reduce outstanding exposures with the CCP should be more likely to be cleared as they allow to reduce CCP margin requirements. Similarly, trades that reduce outstanding bilateral exposures with the counterparty of the contract should be more likely to be kept over the counter, as they allow to flatten books hence reducing capital charges. Incentives between the two counterparties may not always be aligned, plus buyer and seller may have different negotiating power. Albeit data constraints, we model these types of incentives by studying how net outstanding exposures with the CCP influence the decision to clear, separately for buyer and seller of the contract.

[10] OTC transactions are usually covered by bilateral master agreements that permit closeout netting in the event of a counterparty default.

[11] In our framework, the incentives to clear for reducing CCR capital requirements are the same as provided by the incentives to hedge CCR exposures. Regulators have incentivized this hedging behavior with a reduction of CCR capital requirements. So in our framework, CCR exposures and CCR capital requirements are treated in the same way.

When investigating how the credit risk of the counterparty impacts the decision to clear, we find that both the seller and the buyer of the contract manage counterparty exposures, strategically choosing to clear when the counterparty is riskier. Our analysis suggests that benefits in the reduction of CCR exposures and capital requirements provide relevant incentives to clearing members for clearing CCP eligible trades.

When analyzing how characteristics of the contract 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, measured by the level of the CDS spread, is positively related to the probability to clear. However, while daily increases in the CDS spread or CDS spread volatility increase the likelihood of central clearing for the Italian sovereign CDS, the reverse is true for German and French sovereign CDS. Taken together these results suggest that while the main drivers of the decision to clear for the Italian CDS may be CCR capital requirements, for France and Germany margin costs considerations may prevail. Furthermore, we find that larger trades are more likely to be cleared across all three sovereign CDS contracts, indicating that CCR factors may prevail over possible post-trade transparency concerns.[12]

Consistent with the notion that clearing members face incentives to flatten their outstanding net positions with the CCP to reduce margins, we find evidence that when European firms buy European sovereign CDS from US counterparties, the likelihood to clear the contract is higher if the trade reduces the outstanding net position of the European buyer with the CCP. On the contrary, we observe that when American firms buy European sovereign CDS from European counterparties, the likelihood to clear the contract is higher if the European seller had already previously built outstanding net selling positions with the CCP. This indicates that buyer's incentives to avoid wrong-way risk may prevail over seller's incentives to reduce CCP outstanding positions and margin requirements. Overall we find

[12]Cleared contracts are subject to post-trade transparency through the CCP. Non cleared contracts are not, at least until the beginning of 2018 when MiFID II would be effective and the post-trade reporting requirements also for OTC derivatives would be in place. Transparency might offer speculation opportunities to other traders, in particular if the size of the transaction is large.

that the decision to clear is a complex decision not just related to a single contract but to the portfolio holdings and total exposures with the CCPs as well as the incentives the buyer and seller face to reduce counterparty risk and capital requirements.

The paper is organized as follows. In Section 2 we describe the regulatory framework and review related literature. In Section 3 we formulate the hypotheses tested in the paper. In Section 4 we briefly describe the dataset. In Section 5 we provide an overview of trading and clearing in sovereign CDS. In Section 6 we report the empirical evidence regarding the decision to clear or not an eligible contract and finally Section 7 concludes.

2 Regulatory framework and related literature

The regulatory framework underlying the paper follows the agreement the G20 Leaders reached in 2009, which aimed to move standardized 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 CDS market, in particular, turned out to be characterized by highly concentrated and interconnected positions that served as conduit 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.[13]

The primary regulatory actions took place in the U.S. where Congress signed in 2010 the Dodd-Frank Wall Street Reform and Consumer Protection Act (DFA), and in Europe where the European Parliament as well as the Council of Ministers adopted in 2012 the European Market Infrastructure Regulation (EMIR). Both these reforms were designed to promote

[13]The institutions belonging to the OTC Derivatives Coordination Group are: the Financial Stability Board (FSB), the Basel Committee on Banking Supervision (BCBS), the Committee on the Global Financial System (CGFS), the International Organization of Securities Commissions (IOSCO) and the Committee on Payments and Market Infrastructures (CPMI), previously known as the Committee on Payment and Settlement Systems (CPSS).

financial stability by improving accountability and transparency in the financial system. In the US, the Securities and Exchange Commission (SEC) and the Commodity Futures Trading Commission (CFTC) have been given authority to implement the DFA, while in Europe, the European Securities and Markets Authority (ESMA) has been delegated for the implementation of the EMIR.

In the Basel III framework (Bank for International Settlements, 2012), banks' collateral and mark-to-market exposures to the central counterparties are subject to a lower risk weight compared to OTC exposures, while the default fund exposure to the CCP is subject to capital requirements. The framework also includes requirements to exchange initial and variation margins for non-centrally cleared derivatives exposures.[14] In view of these regulatory changes, the OTC Derivatives Assessment Team at BIS performed a study in 2014 to assess incentives to centrally clear OTC derivatives (Bank for International Settlements, 2014). 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 exists for CCP's clearing members, while 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 G20 reforms on the incentives to centrally clear OTC derivatives. The Derivative Assessment Trades (DAT) at FSB conducted a study to understand whether or not G20 regulatory reforms achieved their intended outcomes. The report stressed the difficulties in identifying the fraction of standardized OTC contracts eligible to clear as well as the total fraction centrally cleared, and documented a sensible post-2009 increase in number of contracts cleared for interest rate and credit derivatives.[15] Overall the study indicates that more favorable regulation for cleared transactions combined with higher OTC transactions capital requirements

[14]See "Margin requirements for non-centrally cleared derivatives" (BCBS-IOSCO) and the "Principles for Financial Market Infrastructures" (CPMI-IOSCO).

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

would help incentivize banks to clear new trades.[16]

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 the CCPs; 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 of the key advantages of CCP is that credit risk becomes homogenized, at least as far as clearing members are affected.[17]

Duffie and Zhu (2011) provide a framework where the introduction of clearing for a single asset class, like CDS, could limit netting efficiencies 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 reduce interdealer exposures, but a single non-specialized clearing house can pose systemic risk issues. Acharya and Bisin (2014) show in their theoretical model that central clearing limits the excess risk-taking by the counterparties because of greater transparency and margin requirements. In the model of Biais et al. (2016) central clearing and an optimal margin design mitigate the moral hazard of excessive risk-taking and reduce counterparty risk. This prediction is consistent with Koeppl et al. (2012). Zawadowski (2013) shows that welfare improves when the OTC contracts are taxed to finance a bailout fund. Duffie et al. (2015) in their theoretical model calibrated with DTCC data find that collateral demand does not

[16]Our paper complements the FSB work and extends it along the following dimensions. First, our study is able to distinguish whether the OTC derivatives contracts are eligible for clearing or not, therefore increasing the accuracy of the evidence on the extent of central clearing occurring. Second, by focusing on certain asset derivative class, sovereign CDS in our case, we are able to dig deeper into the main drivers of the decision to clear the derivatives contract.

[17]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 facilitate market liquidity. It allows, for instance, three different counterparties to exit the contracts without the need for an agreement by them and eliminating the credit risk of the offset contracts.

increase with mandatory central clearing. The model of Ghamami and Glasserman (2017) identify three main drivers to centrally clear a transaction when there is no clearing obligation, from the dealer's perspective. 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 position; and the third is the size of the clearing members' contribution to the default fund.

The empirical literature on central clearing and CDS mainly uses DTCC data. Shachar (2012), for example, uses a sample of trades from 2007 to mid-2009 and finds that, as long as the cross exposure between dealers accumulates, the liquidity worsens. Loon and Zhong (2014), using a sample of 132 reference entities cleared by ICE and Markit quoted CDS spread, find that CDS spread increases after the introduction of central clearing, indicating that counterparty risk is priced. Du et al. (2016) using DTCC transaction data find the opposite results, i.e. cleared trades have lower spreads compared to uncleared trades. The latter result is consistent with Arora et al. (2012) who, with a proprietary dataset, show that the counterparty risk is priced, but is economically very small in magnitude. Siriwardane (2015) shows that the high concentration of the market around the dealers results in more volatile CDS premiums, while Mayordomo and Posch (2016) find that central clearing could lead to an increase in market activity especially for riskier dealers.[18]

[18]The literature on CCP and systemic risk is also large. The financial regulators identify the OTC derivatives market as a key source of instability, due to their interconnected nature of CDS counterparties that can potentially collapse in sequential failures of other counterparties (domino effect) starting from the failure of a single counterparty, as stressed by Pirrong (2011). For these reasons, an overarching aim of EMIR regulation is to mitigate the buildup and transmission of systemic risk in the derivative market. Given the large size of the net economic exposures between derivative dealers, the possibility of correlated counterparty failures is systemically important (see Getmansky et al. (2016)). Domanski et al. (2015) discuss how clearing houses could propagate systemic risk in financial markets through domino effects and deleveraging mechanisms. They suggest to increase the financial strength of both clearing members and CCPs and develop robust risk management practices for the clearing houses. Lewandowska (2015) shows by using a simulation approach, that the mandatory clearing of all standardized OTC derivatives by a Central Clearing Counterparty would significantly decrease systemic risk only if the regulators ensure a sufficient number of clearing member and asset cleared. Amini et al. (2015) show how central clearing counterparties not only reduce the systemic risk but also increase the utility of banks through the netting benefits and the redistribution of default management resources within the financial market. Menkveld et al. (2015) analyze the effect of the central clearing counterparties on price stability by looking at the Nordic equity market, and find a volatility and volume reduction without any deterioration in market quality.

Our paper is complementary to the above literature as it provides empirical evidence on the extent of central clearing and the underlying causes for the clearing decision. To our knowledge, this is the first academic paper that empirically investigates these issues.

3 The Drivers of the Decision to Clear: Testable Hypotheses

Central clearing removes direct counterparty credit risk and replaces it with an exposure to a CCP. 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 in part predicated on the requirement that clearing members post adequate capital and maintain sufficient collateral (margin) so that impacts of a defaulting clearing member can be mitigated.

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. The eligibility depends on a number of factors including: 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, the CCPs may define other specific criteria for clearing eligibility of the different types of instruments. In Europe, beyond certain interest rate derivative classes, the clearing obligation concerns only untranched index CDS classes. Hence, to this date, the decision to clear single name CDS contracts has remained voluntary.[19] This creates the necessary conditions to study the factors that may influence the decision to (voluntarily)

[19]See ESMA for further information regarding clearing obligation of derivative contracts available at https://www.esma.europa.eu/regulation/post-trading/otc-derivatives-and-clearing-obligation

clear a CDS single name contract. In this paper we investigate the following question: why only some sovereign CDS transactions currently eligible for central clearing are being cleared while others are not? We analyze, from the clearing member perspective, what are the drivers of this decision by considering the following factors:

1. Riskiness of the counterparty: Counterparty credit risk (CCR) is the risk arising from the possibility that the counterparty may default on amounts owned on a derivative contract. Reduction of relevant CCR exposures should provide a strong incentive to clear contracts. Moreover, post-financial crisis capital requirements are tied to CCR exposures, and these exposures are considered to be lower for cleared contracts than for bilateral trades.[20] We model CCR by studying how the stand-alone risk of the counterparties, proxied by their CDS spread, affect the decision to clear of both the seller and buyer of the contract.

2. Characteristics of the contract: Characteristics of the CDS contract, such as the liquidity and the riskiness of the underlying reference entity, have a direct impact both on margins collected by the CCP and CCR capital requirements. On the one side, riskier and more illiquid contracts could encourage clearing in order to reduce CCR capital requirements, but on the other side, they may entail costly margins with the CCP. We investigate this issue empirically to see which element prevails.

3. Net outstanding positions vis-a-vis the CCP: In principle, trades that reduce outstanding exposures with the CCP should be more likely to be cleared as they allow to reduce CCP margin requirements. However, incentives between the two counterparties may not always be aligned. Moreover, buyer and seller face asymmetric counterparty risks[21] and may have different negotiating power. We model these types of incentives

[20] CCR capital charges capture a firm's counterparties' credit risk upon the valuation of its (derivatives) assets and are defined as the difference between the default-free portfolio value of assets and its true market value.

[21] When buying protection, the maximum loss is 100% (reference entity default with zero recovery) but when selling protection it is smaller since it is related only to a tightening of the reference entity CDS premium.

by studying how net outstanding exposures with the CCP influence the decision to clear, separately for buyer and seller of the contract.

One additional aspect that would be interesting to consider when modeling the decision to clear relates to the incentives the counterparties of the trade face vis-a-vis their outstanding bilateral exposures. Trades that reduce outstanding bilateral exposures with the counterparty of the contract should be more likely to be kept over the counter, as they allow to flatten books and reduce CCR and capital charges. Unfortunately, the data limitations we face make challenging to study the possible trade-off between multilateral netting through the CCP (Factor 3) and bilateral netting between counterparties. For this reason, we leave the investigation of this issue to further research.

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. Also, Factor 1 and 2 may be related through the possible interaction of counterparty credit risk and reference entity risk when assessing capital charges. We analyze the role of the above factors in the decision to clear, using a probit model. Specifically, we examine how clearing members react to the incentives and costs provided by central clearance. We test the following Hypothesis:

Hypothesis 1: Willingness to clear is higher when the counterparty's CDS spread is higher. 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, hence the higher should be the incentive to clear. Previous studies documented how the creditworthiness of a counterparty may affect the demand for central clearing. Du et al. (2016) show that market participants manage counterparty risk by choosing counterparties that are less exposed to the wrong way risk and have better creditworthiness. We measure the CCR as a function of the stand-alone risk of the counterparties, captured by the CDS spread of both seller and buyer. This variable should proxy for the potential reduction in capital requirements reflecting the preferential capital treatment that Basel III regulatory framework created for cleared contracts compared

to OTC ones (Bank for International Settlements, 2012).

Hypothesis 2: Willingness to clear is higher if the reference entity is more risky and contract less liquid. The riskiness and liquidity of the underlying reference entity are closely related to both CCP margins and capital costs. When the reference entity is more risky and less liquid, CCR capital charges for OTC contracts become more severe, but CCP margins for cleared contracts also become higher both at the initial and maintenance level. We formulate Hypothesis 2 as if CCR capital requirement reduction costs were to prevail as a reason to clear over larger margin costs. An additional element strengthening the direction of our hypothesis is that exposures arising from liquid contracts, not only face lower capital charges, but are also more easily offsettable in the OTC market. The riskiness of the contract is proxied in our analysis by (i) the Markit CDS quoted spread and (ii) the percentage change in the CDS quotes from the previous day, (iii) and a forecast of the volatility of the CDS using Exponential Weighted Moving Average Volatility according to RiskMetrics (1996) parameters.[22] The liquidity of the contract is proxied instead by the number of daily trades.

Hypothesis 3: Willingness to clear is larger if the trade decreases the net outstanding exposure vis-a-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 allow to reduce CCP margin requirements, while trades that reduce outstanding OTC bilateral exposures with the counterparty of the trade allow to reduce capital charges. The decision to clear a contract depends on whether bilateral OTC netting efficiency prevails over CCP multilateral netting and whether counterparties' incentives are aligned.[23] When considering this trade-off, the dealers face the problem of evaluating margin costs

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

[23] Another potential 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 back income earned on these assets, the relative marginal returns on the posted collateral can have an impact on the clearing decision.

between bilateral and multilateral netting as highlighted by Duffie and Zhu (2011) and Cont and Kokholm (2014).[24] Unfortunately, due to the data limitations we face, it is difficult to estimate bilateral outstanding positions for non-cleared transactions. Because of this, we currently do not investigate the trade-off associated with managing outstanding exposures on OTC transactions relative to those that are centrally cleared. Our Hypothesis 3 then relates only to the incentives faced by the counterparties with respect to margins posted with the CCP as it formulates that trades reducing outstanding net exposures with the CCP should be more likely to be cleared by virtue of decreasing CCP margin requirements.[25]

Clearing houses usually provide netting services, collateral management and calculation of margins at the portfolio level. [26] Since our database covers only part of the transactions of the clearing members (as we have focused on three sovereign CDS), and due to the fact that most of the clearing members are non-EU, we cannot rebuild their complete open position with the central counterparty across all asset classes and calculate exactly what is the amount of margin that a dealer is required to post. Given the data available, the best we can do is to calculate, for each of our three sovereign CDS, the daily open position of the dealer with the CCP as a proxy of the inventories and the additional costs of a new trade.[27] Given that both counterparties have to post margins, they can achieve netting efficiencies if theyr reduce their exposures with the CCP. Our Hypothesis is then 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, they prefer to clear the new trade only if it is going to take the opposite position (selling CDS) in order to reduce the overall CCP exposure. The same argument applies in the other case, i.e., when a dealer is a net seller with respect to the CCP, they prefer to clear when the next trade is a buy. It is fundamental to recall that both parties must agree

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

[25] We are aware that at this point our analysis can provide only a partial and potentially biased view of the incentive to clear that derives from margin risk management purposes.

[26] See ICE (2015) for further details on margin calculation.

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

on the decision to clear. Unfortunately, with the available data, we cannot jointly test if the probability to clear is larger when both the traders have an incentive to clear because of 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. [28]

4 Data description

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, "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 (TR) registered according to Article 55 title VI or recognized in accordance with Article 77 of the EMIR. Consequently, information of EU counterparties' trades is made available to ESMA and European Systemic Risk Board (ESRB), while country-specific information is made available to 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 both or one of the two is domiciliated 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 the contracts that were entered before August 16, 2012 and are still outstanding, and the new contracts entered after August 16, 2012.

We use the EU wide dataset available at the ESRB. Abad et al. (2016) provide a comprehensive description of the data structure, as well as issues related to data quality. 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.[29] In general, the TRs

[28] The European trade repository data allow us to consistently retrieve inventory positions vis-a-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.

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

provide two types of data: a mandatory report called "trade activity" that contains all the new trades, modifications and cancellations; and a second set of data, called "trade state" with the outstanding positions up to a certain date. We use the trade activity dataset for the daily analysis. We focus our analysis on a subset of Sovereign CDS, where the reference entities are the Republic of Italy (Italy), the Federal Republic of Germany (Germany) and the French Republic (France).

Regarding the sample that we extract from the trading activity raw data, we face a number of challenges that have been extensively described by Abad et al. (2016) and Fache Rousová et al. (2015). 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 German, French and Italian CDS contracts, we first retrieve all the 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 ISIN codes of the sovereign bonds auctioned in the last ten 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 the RED6 code from Markit. Our broad list of underlying securities contains 8,858 unique identifiers, where roughly 2000 are related to sovereign debt, and the remaining to public entities owned by the government 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, both for the OTC and the Exchange Traded Derivative (ETD) repositories.

The initial database consists of 285,169 observations, with initial dates spanning from 2004 to 2016. Roughly 70% of the observations is from 2016, where we observe a sensible improvement in the quality and quantity of data. The EMIR regulation requires that both counterparties report the trade to one of the authorized trade repository (the so-called "double-reporting" obligation). Thus, if a trade involves two EU counterparties, we find both records in the database; when one counterparty is non-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. the notional amount, the upfront payment, the spread). There are three timestamps reported for each transaction: the *reporting timestamp*, that refers to the moment when the counterparty communicates the trade to the TR; the *execution timestamp*, that indicates the moment when the transaction takes place; and (for some trades) the *confirmation timestamp.* We first drop the exact duplicates and the observations where the information regarding the spread (price), the notional, and the upfront together are missing. Then, in order 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. For some trades, the CDS spread is directly reported, while for some others only the indication of the coupon is provided.[30] We keep all the observations even if sometimes the price is not reported or not reliable. We prefer to avoid the use of the reported transaction price in our analysis because of lack of reliability or misreporting issues.

5 Sovereign CDS Transactions

As described in the previous section, the database used for our analysis includes all the sovereign single-name CDS transactions by EU financial institutions. Our analysis focuses on sovereign CDS, and in particular, the most traded European sovereign CDS: Italy (IT), France (FR) and Germany (GE). According to the globally aggregated transaction data provided by the DTCC on the TIW (Trade Information Warehouse) database, in the last quarter of 2016, the Italian CDS was the 5th most traded single name CDS by average daily notional amount, the French CDS was in the 20th position, and the German CDS in the

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

54th position.[31]

Table 1 describes the transactions reported in the EMIR database of the three sovereign CDS, and in particular, the gross and the net notional amounts and the number of counterparties, classified by the type of market participants. The counterparty categories reported in the database are "Banks", "Dealers", "Funds", "Other Institutions" and "Others". The category "Dealers" includes the group of the largest 16 dealers identified by Abad et al. (2016).[32] The category "Other Institutions" includes Insurances, Pension funds, and Non-financial organizations. The category "Others" includes all the non-classifiable institutions. As Table 1 shows, the gross notional amount traded in 2016 and reported in the EMIR database is 797 billion of US dollars (B$). The "Dealers" are the most active with 576 B$ of gross notional amount (74.8% of the total gross notional amount) followed by the category "Banks" (96 B$) and the category "Funds" (95B$) with 12.01% and 11.92%, respectively. The other two categories, "Other Institutions" and "Others", account for 7.72 B$ and 2.19 B$, respectively, that is 0.97% and 0.27% of the total gross notional. These numbers are in line with the evidence provided by earlier studies (e.g. Getmansky et al. (2016), Peltonen et al. (2014), and Abad et al. (2016)) confirming that the CDS market is highly concentrated around a small number of counterparties and that this concentration is a persistent feature.[33]

Regarding the net notional amount, i.e. the difference between the amount bought and sold during 2016, panel A of Table 1 shows that the category "Dealers" presents a net exposure lower than the categories "Funds" and "Banks", 3.70 B$ versus -7.22 B$ and 5.54 B$, respectively. Moreover, "Dealers" in 2016 present a positive net amount, i.e. they are net buyers of CDS protections for the transactions occurred in 2016. Instead, "Funds" and "Other Institutions" are the largest net seller of protections. Among the 16 Dealers, the analysis shows that only 15 are active in the sovereign CDS market of Italy, France,

[31] Other European sovereigns that are in the 100 most actively traded single name CDS are Spain, Belgium and Portugal.

[32] The 16 largest dealers are 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.

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

and Germany. Among the non-dealers, 33 are 'Banks", 233 are "Funds", 40 are "other institutions" like insurances and pension funds, while 123 are institutions whose type cannot be identified.

In the previous section, we highlighted the peculiarities of clearing members versus non-clearing members, as well as the differences in the incentives to clear for the 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;[34] hence, all clearing members are subject to capital requirements. For this reason, we report in Panel B the same information as 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 (CR) and those that are not (NCR).[35]

INSERT TABLE 1 HERE

Table 1 Panel B shows that clearing members are responsible for the largest fraction of contracts, roughly 96% in terms of gross notional amount, considering both cleared or not cleared contracts. The clearing members have a positive net notional of 9.7 B$ versus the negative total net notional amount of −10.3 B$ for the non-clearing members (-2.2 B$ and -8.1 B$, for those subject to capital requirements and those not, respectively). Among the non-clearing members, the large fraction of the transactions is performed by traders not subject to capital requirements, 2.1% of the total gross notional amount corresponding to a gross exposure of 17.1 B$. This group is formed by the largest number of counterparties (266) and has the largest net notional exposure (-8.1 B$). The group of non-clearing members subject to capital requirements, instead, is comprised of only 29 counterparties.

[34]We define the set of clearing members according to the LEI (Legal Entity Identifier) membership list provided by ICE (www.theice.com). However, the same Global Ultimate Owner (GUO) could employ different LEI, which falls into the category of Dealer, Bank, or Fund. Table 1, Panel A, classify each market participant according to the LEI, while Table 1, Panel B takes into account the clearing membership dictated by ICE. For that reason, a LEI whose global ultimate owner is a Dealer or a Bank, falls into the category of Funds in Panel A, but is a Clearing Member on Panel B.

[35]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.

According to ICE,[36] 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, CR and CR14[37];
- The fixed interest rate on the contract is either 25 or 100 basis points 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[38] reports that 1.7 trillions of dollars (T$) of gross notional single name CDS on sovereign bonds are outstanding at the end of the year 2016, and 551 B$ of this amount is cleared. The Financial Stability Board (2017) report indicates that clearing rates for the flow of new transactions in the OTC credit derivatives (both corporate and sovereign) as a whole are estimated at 37% in the EU and in index CDS at 80% in the US. Figure 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 CDS contracts on sovereign bonds. The ratio starts near zero at the beginning of our sample period and increases up to 32% for the single name sovereign CDS and up to 19% for the multi-name index sovereign CDS at the end of 2016.

INSERT FIGURE 1 HERE

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

[37] In addition, both ISDA 2003 and ISDA2014 Credit Derivatives Definitions can be cleared on both CCPs. The CDS for Italy can be cleared on both CCPs, while CDS on Germany and France sovereign debt is accepted only by ICE Clear Credit.

[38] Data from BIS http://stats.bis.org/statx/srs/table/d10.4?p=20162&c=

In our analysis, we investigate the share of clearing vs. not clearing of the selected three sovereign CDS contracts. Differently from the statistics reported by the BIS and FSB, we also report the percentages of contracts that are eligible to clear but are not clear, 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 whether the contracts that are not cleared could not be cleared because they are not standard or because the traders decided not to do so.

Figure 2 reports the percentage of the gross amount cleared, the one eligible for clearing, and the percentage not eligible for clearing. The first bar of Figure 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%, while the share of not clearable contracts is 9%, respectively.

The most common reasons why a contract is not eligible for clearing are the following: the currency of the contract is Euro (89.21%), the tenor is greater 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 indeed a growing trend towards 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 Figure 1 at the end 2016). The percentage is also larger than the fraction of the flows of cleared contracts reported by Financial Stability Board (2017), indicating that central clearing is more pervasive among sovereign CDS reference entities than corporate.[39]

The second bar in Figure 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 slightly larger than that of non cleared contracts (53% vs. 47%). The non-eligible contracts are 8%,

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

therefore among the clearable contracts 58% of the gross notional amount has been cleared (0.53/0.92). This implies that there are significant incentives for clearing members to clear even if clearance of single-names CDS contracts is yet to be made mandatory.

The last bar shows the percentages of cleared and non cleared contracts where at least one of the two counterparties is a non clearing member. In this case, the percentage of the notional amount cleared is close to zero (0.05%)[40], not 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 funds charges and clearing fees that may be deemed too costly to sustain. There exist 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 vs. 8% for clearing members.

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

INSERT FIGURE 2 HERE

Figure 3 shows that independently from 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 distinctions between institutions subject to capital requirements and not. The figure also indicates that there exists 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 those non-

[40]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

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 for the specific needs of their clients (in this category there are banks and insurances). Taken together Figure 2 and Figure 3 show the dichotomy in the behavior of clearing members versus non-clearing members in their decision to clear and the characteristics of the contracts that these different categories of counterparties are entering.

INSERT FIGURE 3 HERE

The histogram in Figure 4 shows the distribution of sovereign CDS contracts' tenor in our sample. The Figure shows that most of the activity is concentrated in the 5-year bucket, that covers around 30% of the total notional amount traded. More generally, 82% of the activity in our sample is concentrated in contracts with maturity less than or equal to 5 years. For short-term contracts (tenor less of one year), the percentage is very small, around 2%.

INSERT FIGURE 4 HERE

Finally, Figure 5 displays the share of the gross amount traded for each of the three reference entities considered: Germany, France, and Italy. The mostly traded contract is the Italian CDS with 68% of the total amount traded in 2016, the second is France with 19%, and the third is Germany with a share around 15%. The ranking of trading activity of these three sovereign CDS contracts follows that of their CDS premia. In the next section we will document how the heterogeneity in risk among the different reference entities plays an important role in the decision to clear.

INSERT FIGURE 5 HERE

6 The Drivers of the Decision to Clear: Empirical Evidence

What are the drivers of the decision to clear? We introduce several variables to test the hypotheses introduced in Section 3, that are summarized in Table 2.

INSERT TABLE 2 HERE

Our set of variables are related to the riskiness of the two counterparties involved in a trade (Table 2 Panel A), the characteristics of the contract and liquidity risk of the trade (Table 2 Panel B), and the inventory position of the dealer with the CCP (Table 2 Panel C). 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 5 year CDS spread for both the buyer of CDS protection (*Spread B_Dealer*) and the seller of CDS protection (*Spread S_Dealer*). From Table 3 Panel A we can see that the traders on average have a CDS spread around 100 bps for all the three contracts.

The characteristics of the single contracts are summarized in Table 3 Panel B. The liquidity of the contract is captured by the variable "N. of Trades", that 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 (i.e., zero trades days are not considered in the statistics). The CDS contracts for the three sovereigns display a relatively similar average number of trades per day, ranging from 128 for Italy to 191 for Germany.[41] The "Log Notional Amount" represents the log of the contracts' notional amount, also quite similar across reference entities. Using daily quotes from Markit, we introduce three variables that

[41] We have far more observation for Italy than for Germany and France because there are fewer days with zero trades.

capture various aspects of the riskiness for each reference entity. The "CDS Volatility" is calculated as the Exponential Weighted Moving Average Volatility of the daily quotes.[42] The three countries display a similar level of volatility in the sample. The "CDS Quote Spread" and "Δ CDS Spread" represents the level of the current CDS spread for each country, and the change in the spread from the previous day, respectively. The different level of riskiness of each country is clear from Table 3 Panel B. The lowest level of CDS spread belongs to Germany (average of 12 bps), while Italy displays a spread roughly ten times larger (average of 128 bps).

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

$$Position\_wt\_CCP_{ijt} = \frac{Net\_Not.\_wt\_CCP_{ijt}}{G.\_Bought\_Not.\_Cl._{ijt} + G.\_Sold\_Not.\_Cl._{ijt}}. \quad (1)$$

where $Net\_Not.\_wt\_CCP_{ijt}$ represents the net notional position with the CCP for the counterparty i, on reference entity j and day t. The gross notional bought and sold are similarly defined. By construction, this ratio varies from -1 to +1, where a negative number implies that the counterparty is a net seller of CDS protection. The statistics of Table 3 Panel B shows that for Germany and France most of the counterparties, either buyers or sellers, have an average positive position (net buyers of CDS protection). The opposite is true for Italy.

In order to formally test our three hypotheses, we estimate the following probit regressions separately for each sovereign CDS reference entity k (Italy, Germany, and France):

$$Pr(Y_{t,k} = 1) = \alpha_0 + \beta \times X_{t,k} + \epsilon_{t,k} \quad (2)$$

where $Y_{t,k}$ is equal to one if the transaction on the reference entity k has been centrally

[42]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 Risk metrics.

cleared, and zero otherwise. The matrix X contains a set of control variables, different for each Hypothesis tested, as well as a month fixed effect.

As presented in Section 5, our database shows that only transactions between two clearing members present a significant fraction of cleared contracts. Therefore, our analysis on the drivers for central clearing concentrates only on the transactions among clearing members and includes only the contracts that are eligible for central clearing. The inclusion of the contracts not eligible for clearing could potentially bias the results. Collateral to be posted or capital requirements do not influence the decision to clear since the characteristics of the contract preclude from the beginning this option.

6.1 Hypothesis 1: Riskiness of the counterparty

Hypothesis 1: Willingness to clear is higher when the counterparty's CDS spread is higher.

In the first Hypothesis, we test whether the riskiness of the counterparty, i.e., the CCR *per se* can influence the willingness to clear a contract, independently from the riskiness and liquidity of the reference entity. The proxy used for detecting the counterparty credit risk is the Dealer CDS spread with a tenor of 5 years.

INSERT TABLE 4 HERE

Table 4 shows the results of the probit estimation, including the CDS Spread of the buyer (Panel A) or the seller (Panel B). In all cases, also including time fixed effect, the coefficients of the CDS buyer or CDS seller are positive and largely statistically significant. Thus, the probability to clear the contract is larger when either the buyer or the seller presents a large credit default risk measured with the CDS spread.

The main differences across the countries are the magnitude of the coefficients. For the German CDS contracts, the coefficients of the buyer or the seller have a comparable size. For the French CDS contracts, the coefficient of the seller is almost twice as big as the one of the buyer, indicating larger probability to clear if the seller is risky, versus the case when the buyer is risky. The same conclusions hold for the Italian CDS contract. In particular, the univariate analysis shows that the coefficient of the CDS of the seller is positive and significant at the 1% level and is three times larger than the CDS of the buyer. This

indicates that in both cases, the larger is the counterparty risk, the larger is the probability that the contract would be cleared.

In summary, in all cases, the spread of the CDS dealers has a positive and significant relation with the probability to clear a contract, both the CCR of the buyer or the seller. These empirical findings confirm the statement on Hypothesis 1.

For a fraction of the Italian CDS contracts cleared, we can identify the two counterparties that clear the contract with the CCP. Table 5 reports the results of the probit estimation including both buyer and seller CDS spread. We find that for both buyer and seller, counterparty credit risk matters. The result is robust to the inclusion of time FE. Overall, Hypothesis 1 is confirmed in our analysis. However, for the same level of counterparty risk, the incentive to clear is almost two times larger when the seller is risky than when the buyer is risky.

INSERT TABLE 5 HERE

6.2 Hypothesis 2: Characteristics of the contract

Hypothesis 2: Willingness to clear is higher if the reference entity is more risky and contract less liquid.

As described in Table 2, Hypothesis 2 investigates the drivers of clearing looking at the following contract's characteristics: the CDS Spread, the change of the CDS spread, the CDS spread volatility, the trade size, and the total number of daily trades. In Section 3 we discussed how some of these variables capture dimensions that might affect both capital requirements and CCP margins, having a contrasting effect on the decision to clear. The empirical analysis here allows us to disentangle which effect is prevailing.

Table 6 reports the results of the multivariate regressions for Germany, France, and Italy, with and without month fixed effect.

INSERT TABLE 6 HERE

In line with Hypothesis 2, when the reference entity is riskier, the probability to clear the contract is larger. The coefficient for the variable "CDS Quote Spread" is positive across

countries, albeit statistically significant at the 1% level only for France and Italy. Higher potential margin costs do not prevent the counterparties to agree on clearance because CCR exposures are prevailing in the decision to clear. For Germany, the coefficients are not significant with and without fixed effect. This could be due to the fact that this variable is quite stable through time or the riskiness of Germany is so low that it is not having a substantial impact neither on margins costs nor CCR exposures. If we perform the same analysis including time fixed effects, the overall results are confirmed.

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 and statistically significant coefficient for Germany and France, in line with the idea that an increase of the CDS spread of the reference entity increases margins, and therefore reduces the incentives to clear. For Italy, the sign of the estimated coefficient is positive, with stronger significance when including also the month fixed effect. This indicates that there may be periods in the sample characterized by specific shocks that increase/reduce the probability to clear (like the outcome of the Brexit vote), potentially inducing bias in the estimation if this aspect is not captured with time fixed effects. Overall, the results on the change in the CDS spread indicates that the potential increase of the risk of the reference entity induces to clear more in line with Hypothesis 2 and CCR exposure motivations, but only for the riskier country in the sample. For Germany and France, margin costs seem to prevail on the CCR exposures for the decision to clear.

The volatility of the quoted CDS spread, "CDS Volatility," has a negative sign for the three countries, indicating that the probability to clear is lower if the contract is more volatile, and therefore characterized by larger margins. However, the inclusion of the time fixed effects changes the magnitude of the coefficient, and for Italy also the statistical significance of the coefficient. The econometric reasons for this result are the same as before: the inclusion of the time fixed effects controls for the variability of clearing activity which is due to time series shocks. It seems, therefore, that for the Italian contract margin costs are not as relevant as the CCR exposures. Overall, these findings confirm that riskiness of the reference entity induces to clear more in line with Hypothesis 2, but only for the riskier country in the sample.

Next, the number of transactions "N. of trades" shows a negative coefficient for all the

reference entities. This indicates that the incentive to clear is lower when the contract is more liquid. The coefficients for Germany and France are not statistically significant when including time fixed effects. This indicates that there are clusters of periods when these contracts are either largely traded and others when their trading activity is low, and this variability is captured by the time fixed effects. These findings are in line with Hypothesis 2 that exposures arising from liquid contracts are less likely to be cleared as they face lower capital charges and are also more easily offsettable in the OTC market.

Finally, considering the trade size ("Log Notional Amount"), the analysis shows that the larger is the volume of the transaction, the higher the probability to clear. Differences in post-trade transparency between cleared and not cleared contracts might suggest that larger trades should be less likely to be cleared as transparency of cleared trades might offer speculation opportunities to other traders. Our empirical results, however, reveal the opposite. If the trader has to choose between the possibility of disclosing the intention to take a large position on a contract or to incur in a large counterparty credit risk exposure, there seems to be a preference for reducing the second one. This result is significant at the 1% level also including the time fixed effects analysis for France and Italy. However, for Germany, the estimated coefficient is not statistically significant, indicating that the CCR exposures are less relevant for the clearing decision.

In the appendix, Table 8, Table 9, and Table 10 report the probit results by regressing the dependent variable (clearing choice) with stand-alone explanatory variables, not controlling for month fixed effect. The analyses of the single variables are characterized by the omitted variable bias. Although these results do not contradict the analysis based on Table 6, they are less robust especially for contracts having Germany as reference entity, where only the variable "N of Trades" remains significant. In particular, "CDS Quote Spread" is still positive but only for France statistically significant; on the contrary, the coefficients are no longer significant for Germany and Italy. "Δ CDS Spread" is negative for France and positive for Italy and in both cases significant. These results are in line with the Table 6, and confirm that margin costs are found to be major incentives impacting the decision to clear for France, and on the contrary, CCR considerations prevail for Italy. Although the sign of "CDS volatility" coefficient is coherent with the results of the Table 10 for all the reference entities, only

for France, it is significant, indicating that the margins are relevant incentives for clearing France sovereign CDS. "N. of Trades" is negative and significant for all the three reference entities, confirming that the incentive to clear is less relevant when the contract is more liquid. Finally,'Log Notional Amount" is positive and statistically significant for Italy and France indicating that the desire to hedge against a counterparty risk exposure overcomes the potential consequential cost of disclosing trading information.

In general, our analysis confirms Hypothesis 2 for Italian CDS contracts: clearance is larger when the reference entity is riskier and therefore CCR exposures motivation for clearing prevails on the margin cost motivation for the decision to clear. For the German CDS, it seems that the incentives that prevail for clearing are those provided by margin costs. For France the results are mixed. It appears that both incentives, provided by margin costs and CCR exposures are relevant for the decision to clear French CDS. The mixed results justify the need to perform a separate analysis of the three contracts.

6.3 Hypothesis 3: Net outstanding exposure vis-a-vis the CCP

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

In this section, we consider the position of the single dealer vis-a-vis the Central Counterparty. We model the decision to clear based on the intuition that, if a transaction helps reducing the outstanding position with the CCP, dealers have the incentive to centrally clear as they lower the amount of collateral needed to be posted with the CCP.

In order to capture this behavior, we use the previous-day position of the counterparty vis-a-vis the CCP (see equation 1), with respect to each reference entity (GE, FR, IT). We define the position as "flat" when the ratio between Net and Gross Notional outstanding is between plus and minus 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 plus one or minus one displays a directional exposure with the CCP. We combine this information with the side of each trader (buyer or seller), and we isolate the two relevant cases: (i) when the buyer of a new contract is a net seller

vis-a-vis the CCP, and (ii) when the seller of a new contract is a net buyer vis-a-vis the CCP.

In principle, if the buyer of a new contract is a net seller vis-a-vis the CCP they would have more incentive to go through the CCP, as they would be able to reduce outstanding exposures to the CCP and consequently margin requirements. The same argument should apply also to the seller. In a CDS contract, however, the counterparty risk of the buyer and the seller is asymmetric. If the seller default, the buyer of protection might not receive the contingent payment in case of a credit event of the insured reference entity (reference entity default with zero recovery). On the other side, if the buyer of protection default, the loss amounts only to the tightening of the reference entity CDS premium. This asymmetry is intrinsic in the CDS contract, and gives the buyer of protection more incentive to clear, especially if they perceive that the creditworthiness of the seller and the underlying reference entity are highly correlated (i.e. "wrong-way risk").

The sample used in this section has some peculiar characteristics. Under EMIR, EU authorities have full visibility of 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 being cleared through a non-European CCP (i.e. Ice Clear Credit), 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. Importantly, France and Germany sovereign CDS are cleared only through Ice Clear Credit, while Italy sovereign CDS is cleared both through Ice Europe and Ice Clear Credit. For all three sovereign CDS, we are therefore able to retrieve Ice Clear Credit inventory positions for European clearing members only. For Italy sovereign CDS, we are able to retrieve Ice Europe inventory positions for both European and non-European clearing members.

Table 7 shows the results of our probit regression when we include, as explanatory variables, dummies capturing the outstanding position of the buyer (Panel A) and the seller (Panel B) vis-a-vis the CCP, respectively. Since we can compute CCP clearing members inventory positions — and therefore dummies — for a limited number of cases, Table 7 reports a significantly lower number of observations compared to Table 6.

INSERT TABLE 7 HERE

Even though trades on European sovereign CDS between two European counterparties are possible in principle (and observable in our dataset) we notice very few of such instances. The vast majority of the transactions captured in our sample are between a European and non-European clearing member. If a European clearing member is buying protection on a sovereign European CDS from a non-European clearing member, we would expect them to have stronger incentives to clear the transaction if that helps reducing their exposure with the CCP, thus reducing margin requirements. The opposite situation is, instead, more complicated due to the potential "wrong-way risk" involved in the transaction: when a Non-European clearing member buys protection on a European Sovereign CDS from a European counterparty they may have strong incentives to clear the transaction if they perceive that the creditworthiness of the seller and the underlying reference entity are highly correlated (i.e. "wrong-way risk"). Even if the (European) seller of protection has no incentives to clear the transaction based on their outstanding exposure with the CCP, the asymmetric nature of the risk involved in the transaction, could give strong enough incentives to the (Non-European) buyer of protection to clear the transaction.

Panel A displays the results for trades that, for the most part, occured between a European buyer and a non-European seller. For all the three countries, when the buyer is a net seller with respect to the CCP (and thus has incentive to clear the contract), the probability to clear is higher. The estimated coefficient is positive and significant at the 1% level. Adding time fixed effect leaves the sign of the coefficients invariant, but reduces the statistical significance for Germany. This result is quite intuitive: the probability to clear a contract is higher if it allows the buyer to reduce outstanding exposures with the CCP and hence margin requirements.

Table 7 panel B reports how the probability to clear is affected by the position of the seller with the CCP. Looking at the descriptive statistics reported in Table 3 Panel C, it appears that for the French and especially the Italian contracts, the position of the single traders is on average close to flat (5.3% for France, and -8.9% for Italy). When the seller has strong incentive to clear the contract (being a net buyer with CCP) to reduce the amount of margins posted with the CCP, the probability of centrally clear a contract actually decreases, giving the negative signs of the coefficient. Another way to restate this result is that when the

European seller enters a trade of a European sovereign CDS having already a net outstanding position as seller vis-a-vis the CCP, the propensity to clear the contract increases.

Our results are in line with Du et al. (2016), where the market participants try to avoid wrong-way risk, i.e., buying protection from a counterparty, whose credit risk is correlated with the underlying risk of the reference entity. These findings seem to sugest that when a European sellers enters a trade of a European sovereign CDS, the buyer's incentive to avoid counterparty risk and wrong-way risk may prevail over the incentive of the seller to reduce margin costs.

Unfortunately, our database does not allow us to identify, for a large fraction of the cleared transactions, who are the two parties. Therefore, we could not disentangle the cases when both counterparties have incentives to clear versus the case when only one does, especially when European and Non-EU counterparties are involved in the trade.

With the data limitations we face we could, in any case, conclude that the results in Table 7 on the one side confirm Hypothesis 3, but on the other side highlight the strategic behavior of clearing members in managing margins costs, counterparty risk, and wrong-way risk. If the buyer has strong incentives to clear the transaction to reduce margin costs they will do so. If the buyer has strong incentives to clear the transaction to reduce counterparty and wrong-way risk, despite the fact that this incentive may be opposite than that of the seller, in most of the cases it will prevail.

7 Conclusion

This paper is a first attempt at analyzing empirically whether post-crisis regulatory reforms developed by global-standard-setting bodies have created appropriate incentives to centrally clear Over-The-Counter (OTC) derivative contracts. We use confidential European trade repository data ruled by the EMIR on single-name European sovereign Credit Derivative Swap (CDS) to test three research hypothesis related to important drivers of the decision to clear: 1) the counterparty credit risk 2) the characteristics of the reference entity; and 3) the multilateral netting opportunity offered by the CCP.

Our results show that the large majority of the transaction cleared in our sample are

between CCP clearing members, while we find little evidence of clearing of transactions by non-clearing members, independently from whether they are subject to capital requirements or not. Non clearing members (banks, funds, insurance companies, pension funds and other non financial organization) are responsible for approximately 5% of the CDS gross notional amount traded but they represent about 50% of the net notional amount outstanding, and they are risk absorber in the system (i.e., they are net sovereign CDS risk sellers). We also find that a large majority of the contracts could be cleared if the clearing members involved in the trade were to agree.

Focusing 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. High counterparty credit risk of both the buyer and the seller seems to be a major factor that significantly increases the probability to clear. The same applies to the size of the transaction: the bigger the notional amount, the larger is the probability to clear, independently from the other characteristics of the trade. Other characteristics of the contract provide instead contradicting results for different European sovereign CDS. The probability to clear is higher if the reference entity becomes more risky but only for the riskier sovereign CDS in the sample, while for safer sovereign CDS the opposite holds true. Our findings suggest that CCP margin 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 the asymmetry in negotiating power and riskiness of the buyer and the seller provides different incentives to clear conditional on the exposure with the CCP and the incentive to reduce CCP margins. When a European firm enters a trade of a European sovereign CDS as a buyer, the propensity to clear the contract increases if it has a net outstanding position as a seller vis-a-vis the CCP. This result holds true for all the reference entities, indicating that buyer's incentives to reduce outstanding portfolio net selling positions (and hence margin requirements) with the CCP matter for the decision to clear new trades. However, we do not find the same incentive to matter for the seller. In fact, the opposite result holds true: when a European firm enters a trade of a European sovereign CDS as a seller, the propensity to clear the contract decreases if it has a net

outstanding position as buyer vis-a-vis the CCP. Another way to restate this result is that when the European seller enters a trade of a European sovereign CDS having already a net outstanding position as a seller vis-a-vis the CCP, the propensity to clear the contract increases, indicating that the incentive of the buyer to potentially reduce CCR and wrong way risk prevails over the incentives of the seller.

Our study has potential policy implications. First, we show that clearing activity of non-clearing members, independently from whether they are subject to capital requirements, is much lower compared to that of clearing members. Despite some recent efforts by a group of global asset managers to clear single-name contracts with the goal of reviving liquidity in the product, the discrepancy of clearing activity with clearing members remains noticeable. This result is relevant for financial stability especially in light of the fact that, post-financial crisis, non-clearing members became risk absorbers (i.e. net seller of protection) in the system. While the clearing benefits for these firms may naturally be lower than those of clearing members (multilateral netting by CCP is typically less effective as non-clearing members tend to have more directional portfolios concentrated across a smaller number of counterparties) other costs such as CCP default funds charges and clearing fees (charged by brokers to absorb costs relative to CCR capital charges and CCP margin requirements) may also constitute a sensible obstacle for client clearing. Further assessment of these costs, the supply of these services by the market, and the potential costraints provided by recent financial regulation on clearing services may be warranted. Policymakers should also reflect on whether the recent introduction of initial and variable margin requirements for bilateral OTC transactions creates enough incentives to clear contracts, in particular for non-clearing members with no capital requirements. Regarding the decision to clear for clearing members, we find that factors impacting the incentives to clear are not the same for reference entity with different risk profiles. Further analysis may be warranted in order to assess the potential non-linearity of incentives related to clearing members CCR capital charges and CCP margin requirements.

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Figures

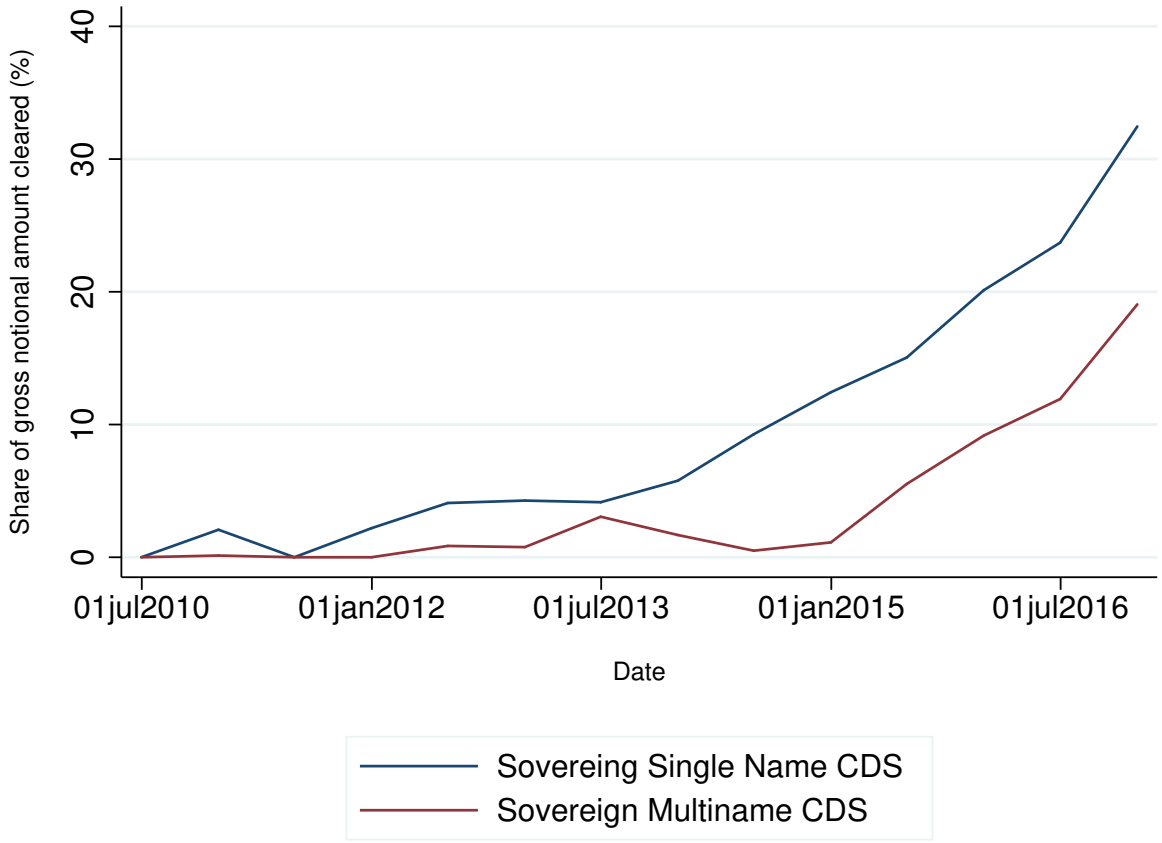

Figure 1: Share of cleared sovereign CDS contracts of gross notional amount
This figure shows the ratio between the gross notional cleared and the total gross notional amount for single name sovereign CDS and multi-name sovereign CDS contracts. The ratio is calculated starting from the semi-annual open positions with a sample from June 2010 to December 2016. The source of data is the BIS over-the-counter (OTC) derivatives statistics database, available at http://stats.bis.org/statx/srs/table/d10.4?p=20162&c=

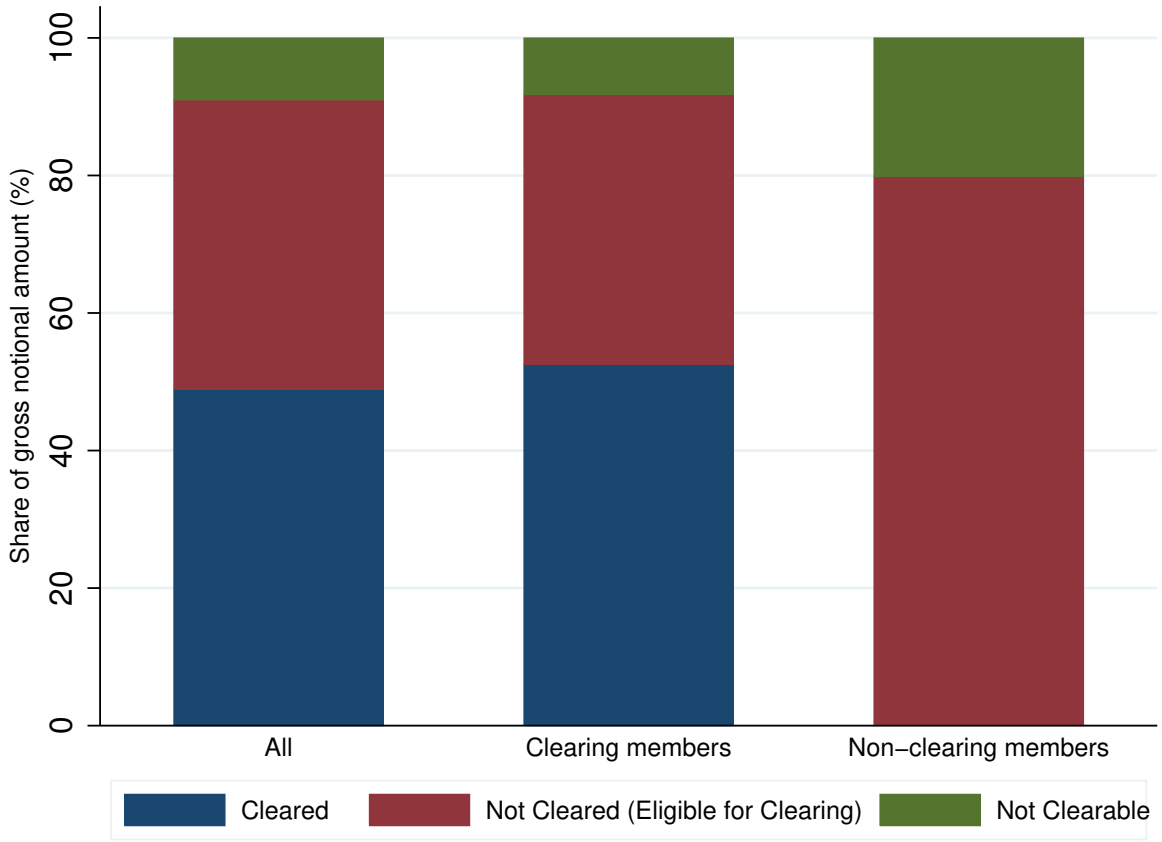

Figure 2: Clearing of sovereign CDS contracts by counterparty type
This figure shows the share of gross notional amount traded in our sample, classifying each trade under the following categories: cleared, not cleared, and not eligible for clearing, as described in Section 5. The first bar includes all contracts traded in our sample, the second bar includes only the contracts where both of the counterparties are clearing members, while the third bar includes the contracts where one of the two counterparties is a clearing member. The sample is composed of single-name sovereign CDS contracts written on Italy, Germany and France as a reference entity in 2016. Data comes from trade repositories under the the EMIR reporting requirement.

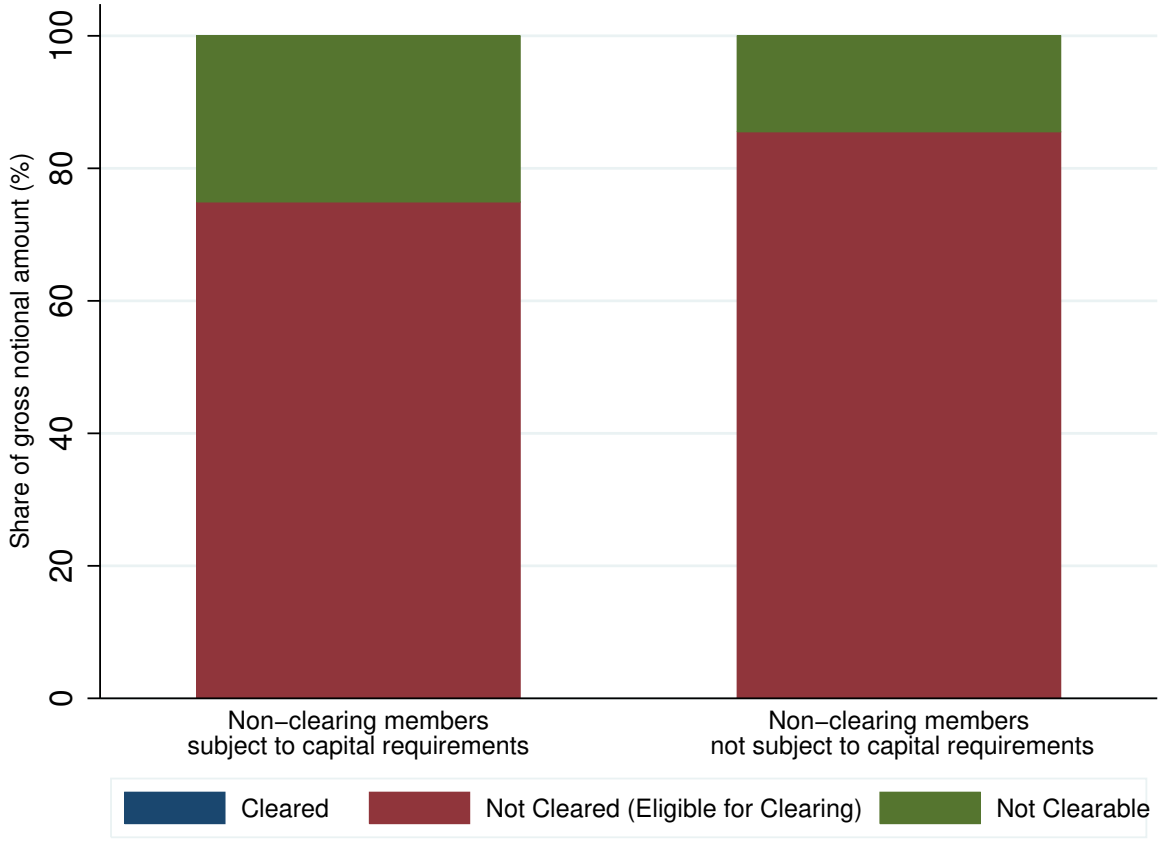

Figure 3: Central Clearing Eligibility, Client Clearing and Capital Requirements
This figure shows the share of gross notional amount traded in our sample, including only the trades where only one of the two counterparties is a clearing member. We classify each trade under the the following categories: cleared, not cleared, and not eligible for clearing, as described in Section 5. The first bar includes all the contracts where the non-clearing member is subject to capital requirements. The second bar includes all the contracts where the non-clearing member is not subject to capital requirements. The sample is composed of single-name sovereign CDS contracts written on Italy, Germany and France as a reference entity in 2016. Data comes from trade repositories under the the EMIR reporting requirement.

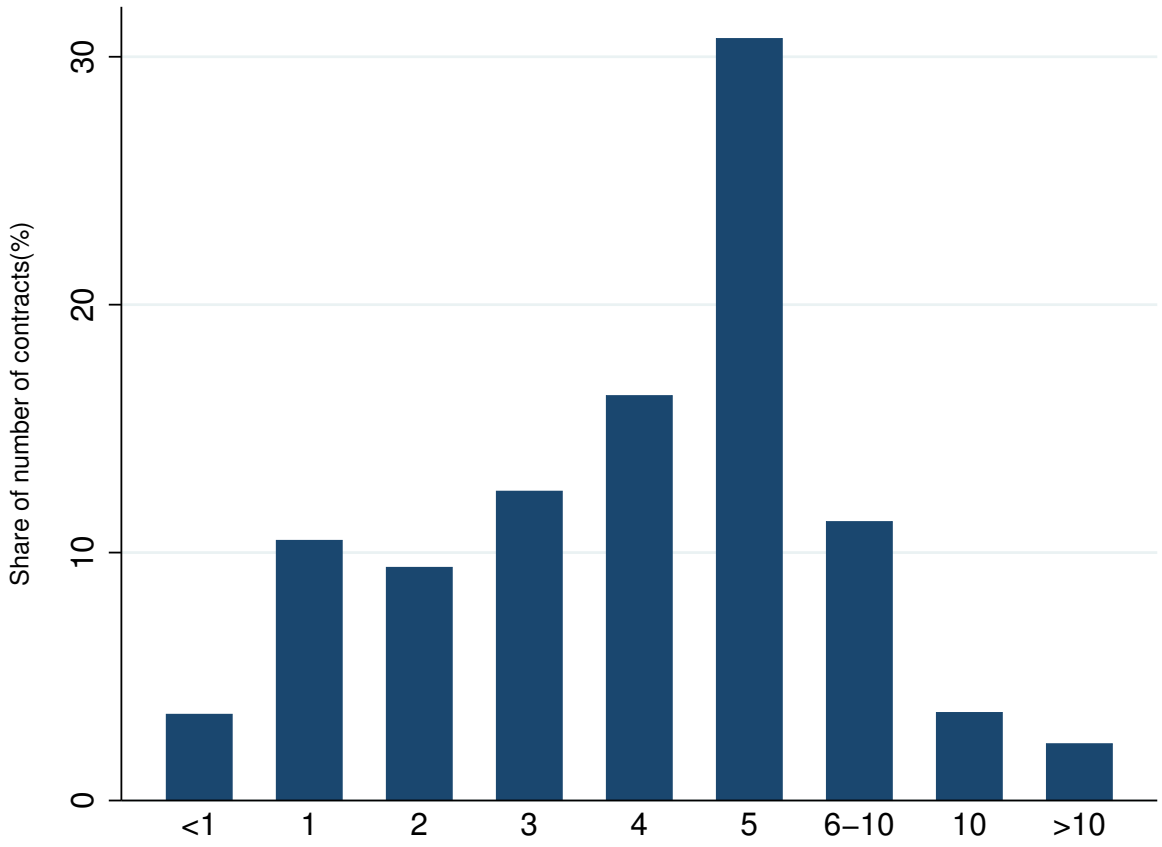

Figure 4: Distribution of sovereign CDS contracts' tenor
This figure shows the relative frequency of CDS transactions, grouped by buckets of tenors. The sample is composed of single-name sovereign CDS contracts written on Italy, Germany and France as a reference entity in 2016. Data comes from trade repositories under the the EMIR reporting requirement.

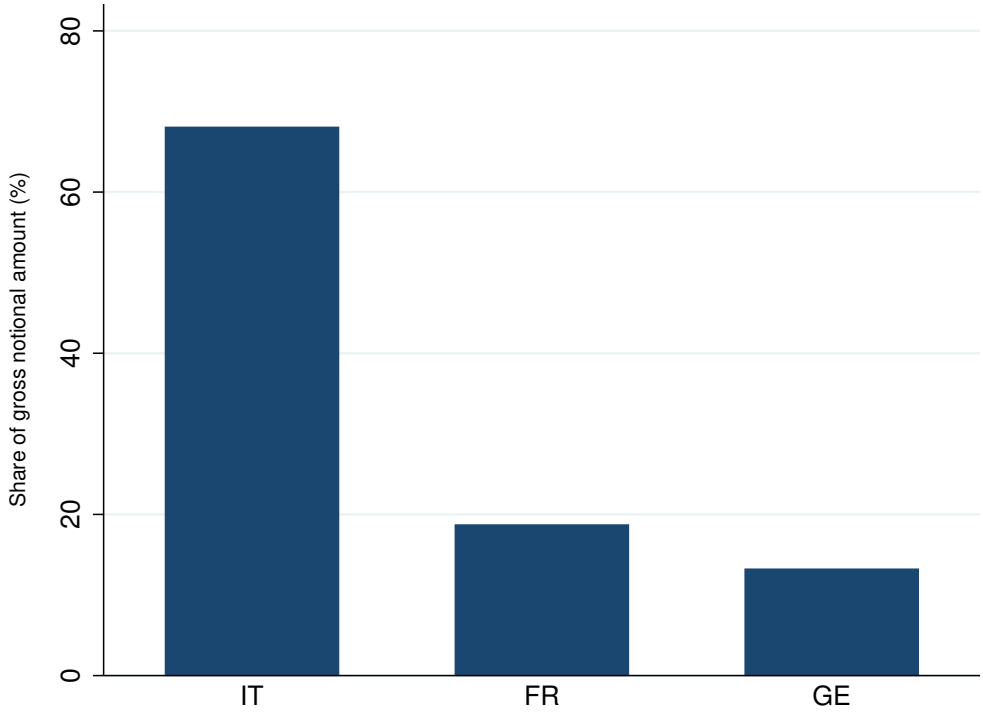

Figure 5: Share of the gross notional amount traded
This figure shows the share of the total gross notional amount traded for each of the three sovereign CDS reference entity included in our sample. The sample is composed of single-name sovereign CDS contracts written on Italy, Germany and France as a reference entity in 2016. Data comes from trade repositories under the the EMIR reporting requirement.

Tables

Table 1: Notional amounts and number of counterparties by type of market participant

For both panels, we report the gross notional amount both in US dollar billion and in percentage, 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 category "Other Institutions" includes Insurances, Pension, and Not financial organizations. The category "Others" contains all the others not classifiable institutions. Panel B shows the data by institutions grouped in categories: "Non-Clearing Members (CR)" are the non-clearing members institutions subject to capital requirements", "Non-Clearing Members (NCR)" are the non-clearing members institutions not subject to capital requirements, while "Others" holds all the other non-classifiable institutions.

Panel A

Market Participants	Gross Notional Amount (B$)	Gross Notional Amount (%)	Net Notional Amount (B$)	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 Inst.	7.7	1.0%	-2.1	40
Others	2.6	0.3%	0.0	123

Panel B

Market Participants	Gross Notional Amount (B$)	Gross Notional Amount (%)	Net Notional Amount (B$)	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%	-0.3	123

Table 2: Description of variables
The table shows the explanatory variables used for testing the following three Hypothesis: 1) Counterparty Credit Risk (Panel A). 2) Contract and Liquidity Risk (Panel B), 2) Position with the CCP (Panel C) and The table reports the variables considered, their description and data source.

Panel A HP 1 : Counterparty Credit Risk

Variable	Description	Data source
Spread Buyer - 5Y	Buyer CDS spread with Tenor 5 years	Markit
Spread Seller - 5Y	Seller CDS spread with Tenor 5 years	Markit

Panel B Hypothesis 2: Contract and Liquidity Risk

Variable	Description	Data source
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

Panel C Hypothesis 3 : Position with the CCP

Variable	Description	Data source
Seller is net buyer with CCP (Dummy)	Net buyer sells protection: Trades where the Seller is a net buyer	EMIR
Buyer is net seller with CCP (Dummy)	Net seller buys protection: Trades where the Buyer is a net seller	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

Table 3: Descriptive statistics

The table shows descriptive statistics for the explanatory variables used for testing the following three hypotheses: 1) Counterparty Credit Risk (Panel A), 2) Contract and Liquidity Risk (Panel B), and 2) Position with the CCP (Panel C).

Panel A

	GE			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

Panel B

	GE			FR			IT		
Variables	**N. Obs.**	**Mean**	**S.dev.**	**N. Obs.**	**Mean**	**S.dev.**	**N. Obs.**	**Mean**	**S.dev.**
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
Δ CDS Spread	1336	0.036	0.659	2705	0.231	1.172	8219	0.172	4.650

Panel C

	GE			FR			IT		
Variables	**N. Obs.**	**Mean**	**S.dev.**	**N. Obs.**	**Mean**	**S.dev.**	**N. Obs.**	**Mean**	**S.dev.**
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

Table 4: Hypothesis 1: Counterparty Credit Risk
This table shows the estimated probit model results for contracts having Germany France and Italy as reference entity, and where both of the counterparties are clearing members (CM). The dependent variable is a dummy variable equal to one when the contract is cleared. Panel A reports the impact of the buyer CDS spread on the probability to find a contract cleared. Panel B reports the impact of the seller CDS spread on the probability to find a contract cleared. Month fixed effects controls are included.

Panel A

	GE		**FR**		**IT**	
Models	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Spread Buyer - 5Y	0.010***	0.025***	0.010***	0.020***	0.004***	0.0066***
	(0.003)	(0.003)	(0.002)	(0.003)	(0.001)	(0.0009)
Constant	-2.035***	-3.272***	-2.193***	-2.341***	-1.083***	-1.271***
	(0.298)	(0.463)	(0.249)	(0.377)	(0.079)	(0.144)
Observations	751	751	1,601	1,601	4,162	4,162
Adj R2	0.017	0.121	0.014	0.073	0.004	0.0431

Panel B

	GE		**FR**		**IT**	
Models	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Spread Seller - 5Y	0.013***	0.025***	0.019***	0.023***	0.012***	0.0154***
	(0.003)	(0.003)	(0.002)	(0.003)	(0.001)	(0.0010)
Constant	-2.226***	-3.197***	-3.055***	-2.803***	-1.938***	-1.677***
	(0.282)	(0.435)	(0.197)	(0.344)	(0.088)	(0.147)
Observations	768	768	1,638	1,638	4,176	4,176
Adj R2	0.027	0.145	0.092	0.144	0.052	0.110
Month FE	N	Y	N	Y	N	Y

Robust standard errors in parentheses: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

Table 5: Hypothesis 1: Counterparty Credit Risk estimations for Italian sovereign CDS

This table shows the estimated probit model results for the contracts having Italy as reference entities, and where counterparties are clearing members (CM). 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. In the models presented in the second column of the table, controls for month fixed effects are included.

Models	**(1)**	**(2)**
Spread Buyer - 5Y	0.005***	0.008***
	(0.001)	(0.001)
Spread Seller- 5Y	0.0097***	0.0119***
	(0.001)	(0.002)
Constant	-3.158***	-4.669***
	(0.129)	(0.413)
Observations	2,814	2,226
Adj R2	0.042	0.193
Month FE	N	Y

Robust standard errors in parentheses: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

Table 6: Hypothesis 2: Contract and Liquidity Risk estimations for sovereign CDS
This table shows the estimated probit model results for contracts having Germany France and Italy as reference entity, and where both of the counterparties are clearing members (CM). 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 (ΔCDS 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). In the model presented in the last column of the table, controls for month fixed effects are included.

	GE		**FR**		**IT**	
Models	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
CDS Quote Spread	0.0008	0.0006	0.0067***	0.0098***	0.0016***	0.0028***
	(0.0048)	(0.0054)	(0.0022)	(0.0023)	(0.0004)	(0.0005)
Δ CDS Spread	-0.163*	-0.270**	-0.125***	-0.122**	0.0074*	0.0188***
	(0.0964)	(0.127)	(0.0469)	(0.0579)	(0.0040)	(0.0045)
CDS Volatility	-12.72***	-34.86***	-14.09***	-6.873**	-0.473	5.358**
	(3.496)	(8.142)	(2.753)	(3.398)	(1.606)	(2.292)
Log Notional Amount	0.0272	0.0249	0.224***	0.237***	0.262***	0.265***
	(0.0321)	(0.0327)	(0.0278)	(0.0336)	(0.0134)	(0.0142)
N. of Trades	-0.0019***	-0.0007	-0.0011***	-0.0006	-0.0016***	-0.0011***
	(0.0003)	(0.0004)	(0.0002)	(0.0003)	(0.0001)	(0.0001)
Constant	-0.208	0.424	-3.917***	-3.870***	-4.541***	-4.558***
	(0.568)	(0.644)	(0.471)	(0.593)	(0.242)	(0.271)
Observations	832	832	1,713	1,713	5,132	5,132
Adj R2	0.0614	0.147	0.140	0.157	0.0987	0.136
Month FE	N	Y	N	Y	N	Y

Robust standard errors in parentheses: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

Table 7: Hypothesis 3: Position with the CCP
This table shows the estimated probit model results for contracts having Germany France and Italy as reference entity, and where both of the counterparties are clearing members (CM). The dependent variable is a dummy variable equal to one when the contract is cleared. Panel A shows the estimation results when considering the buyer side. The first explanatory variable is a dummy equal to one when the buyer is a net seller with the CCP . Panel B indicates the estimation results when considering the seller side. The first explanatory variable is a dummy equal to one when the seller is a net buyer with the CCP. In the models presented in the last two columns of the table, controls for month fixed effects are included.

Panel A

	GE		**FR**		**IT**	
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Buyer is net seller with CCP (Dummy)	0.598**	0.303	0.886***	0.775***	0.130***	0.140***
	(0.299)	(0.319)	(0.122)	(0.128)	(0.047)	(0.049)
Constant	-0.598***	-0.319**	-0.820***	-0.249	-0.297***	0.008
	(0.043)	(0.160)	(0.032)	(0.153)	(0.018)	(0.090)
Observations	224	205	416	416	2,159	2,159
Adj R2	0.003	0.110	0.024	0.059	0.001	0.0431

Panel B

	GE		**FR**		**IT**	
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Seller is net buyer with CCP (Dummy)	-1.008***	-0.946***	-0.907***	-0.976***	-0.304***	-0.279***
	(0.135)	(0.152)	(0.0877)	(0.098)	(0.0349)	(0.036)
Constant	0.305**	0.628***	0.0156	0.806***	-0.076***	0.266***
	(0.128)	(0.220)	(0.081)	(0.168)	(0.028)	(0.097)
Observations	199	199	456	456	2,251	2,251
Adj R2	0.048	0.146	0.0493	0.089	0.009	0.049
Month FE	N	Y	N	Y	N	Y

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

8 Appendix

Table 8: Hypothesis 2: Contract and Liquidity Risk estimations for German sovereign CDS

This table shows the estimated probit model results for contracts having Germany as reference entity, and where both of the counterparties are clearing members (CM). 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 (ΔCDS 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).

	GE				
Models	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
CDS Quote Spread	0.0033				
	(0.0043)				
Δ CDS Spread		-0.149			
		(0.0965)			
Log Notional Amount			0.0081		
			(0.0260)		
CDS Volatility				-2.075	
				(2.854)	
N. of Trades					-0.0018***
					(0.0002)
Constant	-0.663***	-0.628***	-0.720*	-0.442***	-0.216***
	(0.0714)	(0.0432)	(0.432)	(0.0941)	(0.0633)
Observations	989	989	1,004	832	1,004
Adj R2	0.0005	0.002	0.0001	0.0005	0.0551
Month FE	N	N	N	N	N

Robust standard errors in parentheses: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

Table 9: Hypothesis 2: Contract and Liquidity Risk estimations for French sovereign CDS

This table shows the estimated probit model results for contracts having France as reference entity, and where both of the counterparties are clearing members (CM). 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 (ΔCDS 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).

	FR				
Models	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
CDS Quote Spread	0.0064***				
	(0.0021)				
Δ CDS Spread		-0.105**			
		(0.0462)			
Log Notional Amount			0.211***		
			(0.0241)		
CDS Volatility				-7.759***	
				(2.602)	
N. of Trades					-0.0012***
					(0.0002)
Constant	-0.966***	-0.766***	-4.121***	-0.511***	-0.554***
	(0.0715)	(0.0314)	(0.395)	(0.0727)	(0.0467)
Observations	1,997	1,997	2,034	1,716	2,034
Adj R2	0.0052	0.0051	0.0935	0.0059	0.0170
Month FE	N	N	N	N	N

Robust standard errors in parentheses: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

Table 10: Hypothesis 2: Contract and Liquidity Risk estimations for Italian sovereign CDS

This table shows the estimated probit model results for contracts having Italy as reference entity, and where both of the counterparties are clearing members (CM). 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 (ΔCDS 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).

	IT				
Models	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
CDS Quote Spread	0.0004				
	(0.0004)				
Δ CDS Spread		0.0085**			
		(0.0035)			
Log Notional Amount			0.263***		
			(0.0123)		
CDS Volatility				0.742	
				(1.460)	
N. of Trades					-0.0016***
					(0.0001)
Constant	-0.336***	-0.282***	-4.598***	-0.289***	-0.0822***
	(0.0544)	(0.0166)	(0.206)	(0.0435)	(0.0220)
Observations	5,925	5,925	5,816	5,282	5,985
Adj R2	0.0001	0.0007	0.0846	3.51e-05	0.0186
Month FE	N	N	N	N	N

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