Always look at the bright side? Central counterparties and interbank markets during the financial crisis

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Abstract

During the financial crisis Italian banks significantly step up their use of Central Credit Counterparties (CCPs) for their funding. Two factors were widely mentioned as important determinants of this growing recourse to central counterparties: the increase in general market uncertainty and that of individual banks' riskiness. Depending on which factor is more relevant, implications for financial stability may be different: if uncertainty is the predominant factor, the use of CCPs may allow a smooth functioning of interbank markets; while, if individual banks' riskiness is the main determinant, the recourse to CCPs may weaken market discipline (by allowing riskier banks, excluded from the bilateral segment, to fund themselves in the interbank market), potentially increasing the overall risks borne by the financial system. We find that the use of CCPs by Italian banks during the crisis is related to both uncertainty and individual risk. In order to try to shed light on the relative role of the two factors, we then examine how variations in the use of CCPs are related to changes in the average duration of interbank bilateral relationships. Under the hypothesis that habitual counterparts, being more informed, react more to bank-specific risks and less to general market uncertainty than occasional counterparts, a negative relationship between average duration and changes in the recourse to CCPs signals that are the most informed counterparts to withdraw from bilateral relationships: this is indeed the case for the riskier decile of banks during all the crisis. For the rest of the banking system, viceversa, we find that variations in the average duration has no significant effects on variations in the use of CCPs suggesting that, overall, the surge in centrally cleared transactions is unlikely to be associated to a significant deterioration of interbank counterparty risk.

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1 Introduction

A notable feature of the last financial crisis has been the stress in the interbank markets and its repercussions on the transmission mechanism of monetary policy and the whole financial system. In several countries, however, interbank activity did not remarkably decline, but it rather showed a clear change in its functioning with a significant surge in secured lending, notably via Central Credit Counterparties (CCPs), i.e. third parties that mediate the lending operations between two banks for the purpose of reducing counterparty risk for the lending bank.[1] In Italy, banks stepped up their recourse to CCPs for their funding in a strikingly way since 2009, with a sixfold increase of borrowed funds in less than four years. The role of centrally cleared interbank transactions increased both as a share of total assets (Figure 1) and as a share of total interbank exposures (Figure 2). The ratio between the number of banks operating via CCPs and the total number of banks operating in the interbank markets also increased significantly (Figure 3). This exponential increase mostly made up for the sharp decline in *bilateral* interbank funding with foreign banks (Figure 4).

[FIGURES 1, 2,3 AND 4 ABOUT HERE]

Overall, the Italian experience seems to lend support to the thesis that "[j]urisdictions that had CCPs for their repo markets in place before the crisis were relatively less affected than those that did not" (Chatterjee et al., 2012). Yet, along with this widely recognized positive effect (see also Mancini et al., 2015), the increased role of CCPs may also entail some risks for financial stability. Not only it may lead, as it is well known, to a concentration of risk within CCPs, turning them into institutions of unprecedented systemic importance (Coeure, 2014), but it may also increase the overall risk borne by the financial system if the increased use of CCPs is concentrated among borrowers which would have been otherwise cut off from the (bilateral segment of the) interbank

[1] Usually repos via CCPs are structured as follows: i) the borrowing bank enters into a repurchase agreement with the CCP, borrowing the required amount and providing collateral; ii) the lending bank enters into a reverse repo with the CCP; iii) the CCP administers the transaction and the collateral, acting as the direct counterparty to the seller and to the buyer, thus assuming the risk of borrower default. In addition, collateral management is highly standardised in terms of profiling and margining, which enhance transparency, and the administrative burden for borrower and lender is significantly lower than in a bilateral repo. In the Italian case participants in the segment are basically all banks, and this is likely to be the case in other countries too, at least in the euro area. For this reason, the ECB decided in 2012 to exclude, retroactively from June 2010, repos with CCPs from the reference monetary aggregate M3 (see Box 3 in the September 2012 ECB Monthly Bulletin).

market due to their riskiness. The impact on financial stability is basically related to the underlying factors driving the recourse to the CCPs. If the shift toward centrally cleared transactions is mainly explained by a general increase in uncertainty and risk aversion of lending banks, then the growing role of CCPs has a positive impact on financial stability because it may avoid the freezing of the interbank market. Viceversa, if the same shift is basically due to the rising individual default risk of borrowing intermediaries, then the policy implications are much less reassuring because it may allow riskier borrowers to escape market discipline increasing the risk borne by the financial system as a whole.

This paper looks at the determinants of the use of CCPs since 2004, the actual start of their activity in the Italian repo market, up to 2013, with the primary goal of evaluating the relative role of the two factors above. Our analysis of determinants shows that, before the start of the financial crisis, intermediaries participating to CCPs were mainly large banks, banks with a relatively weaker retail funding base and banks lacking strong bilateral customer relationships in the interbank market (Affinito, 2012, shows that these relationships were quite relevant in the Italian market). With the crisis, the significance of these factors mostly fade away, while both uncertainty and individual risk become relevant.[2] We then examine the relation between variations in the use of CCPs and in the weighted average duration of bilateral interbank relationships as a measure that may help to disentangle the impact of aggregate uncertainty and the individual risk of an intermediary. The underlying idea is that older interbank relationships are affected more by bank-specific risks and less by market uncertainty (due to the informational advantages that characterize long-term relations) while the opposite holds true for newer relationships. This hypothesis translates in a different relation, ceteris paribus, between variations in the duration of bilateral relationships for each bank and those in the use of CCPs: if the use of CCPs is mainly driven by the general uncertainty, the expected coefficient associated to the duration is positive; instead it is negative if bank-specific risks are the prevailing factor in driving variations in the share of CCPs transactions. Our results show that for riskier banks (those in the last decile of the distribution of our default risk indicator) changes in the share of CCPs transactions are negatively and significantly associated to variations in the duration of bilateral relationship during all the crisis, a sign of the drying-up of interbank funding from longer standing counterparts in the bilateral segment of the interbank market. For the remaining banks, however, the relation is not significant, suggesting that for them the use of CCPs is not driven by

[2]The *participation* of riskier banks to CCPs becomes instead less likely, possibly due to the increased costs to use CCPs as a consequence of the tighter risk control frameworks gradually adopted. It has to be noted, however, that the increased use of CCPs all along our sample period is mostly explained by the intensive margin.

levels of risk unacceptable for banking counterparts.

To understand the possible financial stability implications of the rising role of CCPs, it may be useful to look at the interesting analogies, underlined by Gorton-Metrick (2012), with the emergence of the clearinghouses in the United States and in particular with their role during the XIX century banking runs (Gorton 1985; Gorton-Mullineaux, 1987). As for the positive implication, the key analogy is that the clearinghouse suppressed, during banking panics, the relevance of bank-specific information by issuing loan certificates, a clearinghouse liability appositely created that was a joint liability of member banks. These certificates were issued with a discount over the value of the assets which were posted by banks as collaterals and if a member bank defaulted and the collateral was insufficient to cover the member's outstanding certificates, losses were shared by the remaining member banks (Gorton, 1985). The similarities with the safeguards put in place by modern CCPs (e.g., default funds and haircuts) and the analogy with respect to the (intended or unintended) function of making bank-specific information less relevant during the crisis can hardly be missed[3]. In this vein, the recent rise in CCPs transactions may be interpreted as a way to allow the proper interbank market functioning during the crisis by restoring the information insensitivity of the interbank debt (Carapella-Mills, 2012), ensuring its resilience and a stable source of funding for the intermediaries (Mancini et al., 2015).[4]

At the same time, the reference to the historical circumstances also suggests the financial stability negative potential implication. The growing importance of CCPs might, in principle, also signal the difficulties of (riskier) borrowers in acceding to the interbank market. Indeed, Angelini et al. (2011) find that prior to the crisis banks did not differentiate lending conditions based on borrowers creditworthiness while they start to do so afterwards. In this vein, Cappelletti et al. (2011) mention the possibility that the recourse to CCPs reflects not only the desire of lenders to attenuate counterparty risk, but also the need of some borrowers to elude market discipline (and, possibly, some preference for anonymous transactions to avoid any form of 'stigma effect'). The self-selection of riskier banks into this market segment, if any, might increase the overall risks borne by CCPs and, due to their systemic nature, those for the financial system as a whole.

To control their risks, central counterparties adopt several financial safeguards: mem-

[3]In fact, as noted by Gorton-Mullineaux (1987), the weekly publication of individual bank statements was suspended during panics and replaced by weekly statement of the clearinghouse itself.

[4]Gorton and his co-authors use the term information insensitivity to indicate that the debt is immune to adverse selection in trading because agents have no desire to acquire private information about the health of the issuer.

bership eligibility requirements, margins, capital and financial resources[5]. According to Coeure (2014): "CCPs offer state-of-the-art margining and risk management methods that do not exist to the same extent in the bilateral world, which either relies on standardised margining methods that are not very risk-sensitive or on bank-internal margining models that may not necessarily meet the same high standards that CCPs are required to meet". However, according to Pirrong (2011) "CCP margins typically depend on product risk characteristics, rather than the creditworthiness of the clearing member. [...] margins that do not vary meaningfully [...] underprice the risks of less creditworthy firms and overprice the risks of more creditworthy firms, which tends to lead the former to trade too much, and the latter too little. [...] CCPs also monitor the creditworthiness of their members, but this monitoring is largely based on standards and information (e.g., accounting statements) that do not reflect variations in creditworthiness among members in a discriminating way. Moreover [...] the CCP typically does not impose differential capital or margin requirements on members that meet a certain creditworthiness threshold."

Whatever the judgment about the risk control frameworks, as long as the resources provided by the defaulting member (either margins or contributions to the default fund) are sufficient to compensate the lender, centrally cleared transactions are not different in substance from secured bilateral transactions. If this is not the case, however, the quality of the pool of borrowers starts to matter as compensations to the lenders will draw from a common pool (the CCP capital) that may prove insufficient. It is important to note that a member of a CCP can increase the risk it faces even if its own exposure does not change, due to the mutualisation of the losses (Arnsdorf, 2012). This is a significant distinction between bilateral counterparty risk and the risk involved in CCP transactions and it may act as disincentive, from an individual intermediary's point of view, to join the central counterparty if other members are deemed too risky.[6] Even if

[5]The so called "default waterfall" refers to the order in which resources available to a CCP to cover losses arising from the default of a clearing member will be used. Typically, the waterfall envisages first the use of the available resources of the defaulting member (initial margins and then its default fund contribution). Following up, the CCPs capital is used and then the default fund contributions of surviving members. Further down, other rules may be envisaged to face the situation (either as part of the waterfall or as a part of so-called end-of-the-waterfall situations, following the exhaustion of all the safeguards contemplated in the default waterfall).

[6]According to Heider et al. (2015), when the level and dispersion of counterparty risk are low, the unsecured interbank market functions smoothly. The cost of the externality induced by the fact that safer banks *de facto* subsidize the liquidity of riskier banks is small compared to the cost of obtaining liquidity outside the unsecured market. For higher levels of risk, however, there can be adverse selection in the interbank market and the externality on safer banks may be so costly that they leave the unsecured market and interest rate rises to reflect the presence of riskier banks. Although they do not investigate

the risk is remote that defaults are so numerous, and collateral value insufficient, to hit the CCPs, first, and the surviving intermediaries then, it is still possible that a perceived deterioration of borrowers' quality beyond a certain threshold *may deter safer lenders from joining the markets* to avoid any risk, however remote, of being called to pay for residual losses.[7] Risk control measures are usually deployed but if they cannot identify in a granular way the different levels of risk they may end up raising the costs of using the system for all the members, whatever their level of risk, encouraging a return to bilateral trading and losing in this way the benefits of centrally cleared transactions mentioned above.

The rest of the paper illustrates the main features of our analysis, starting in Section 2 with a description of our empirical analysis. Section 3 reviews our data. Section 4 summarizes our results. Section 5 concludes.

2 Empirical analysis

Our analysis focuses on the liabilities of banks with the CCPs for two reasons. First, we are interested in the counterparty risk of borrowers as a potential concern for the functioning of CCPs. Second, Italian banks have mainly been net borrowers on the centrally cleared repo markets (Figures 1 and 2).[8]

We run two econometric exercises. First, we start by looking at the determinants of CCPs exposures estimating in formal terms the following equation:

$$\mathrm{SH}_{jt} = \alpha_0 UNC_t + \beta_0 Risk_{jt} + \gamma_0 Bilateral_{jt} + \alpha_1 UNC_t * CR1_t + \alpha_2 UNC_t * CR2_t + \beta_1 Risk_{jt} * CR1_t + \beta_2 Risk_{jt} * CR2_t + \gamma_1 Bilateral_{jt} * CR1_t + \gamma_2 Bilateral_{jt} * CR2_t + \delta\prime KR_{jt} + \zeta\prime b_j + \eta\prime p_t + \epsilon_{jt} (1)$$

where SH_{jt} is the share of interbank borrowing exposures through CCPs over total interbank exposures (that is, including also bilateral transactions, secured and unsecured, domestic and abroad) of bank j at time t, in each month from June 2004 to June 2013. In equation (1), we have three key sets of explanatory variables. The first key

potential spillovers between the secured and the unsecured money market segments in their model they mention them as an issue that can be explored along those lines.

[7] To strenghten their risk management framework, in the last couple of years the main central counterparties operating with Italian banks have, first, increased the amount of the guarantees (margins and default funds) asked to members in relation to their net exposures as well as the margins that the CCPs themselves exchange to protect against reciprocal default risk (Bank of Italy, 2013a).

[8] This also means that we would have lacked the data on the lending side as we have no data for foreign lenders on CCPs.

explanatory variable is a general measure of uncertainty and risk aversion in the market, UNC_t, computed as the ratio between the density estimated using historical data from the benchmark index for the Italian stock exchange and the risk-neutral density derived from the options on the index. [9] Since most accounts of the developments in interbank markets during the crises have stressed the role of general uncertainty as an important driver of the shift to secured and centrally cleared transactions, this variable aims at identifying whether or not the rising role of CCPs has been more influenced by the increase in the general uncertainty and risk aversion rather than by an increase in individual riskiness of borrowing banks.

The second key set of regressors $Risk_{jt}$ complements the previous covariate and includes proxies of individual riskiness of borrowing banks. We use two proxies. The first variable, *Bad Loans*, is a balance sheet measure of banks' health and soundness. The second variable, *Rating*, captures the point of view of rating agencies: it is coded so as to take values from 1 to 11, where 1 corresponds to the best rating class and 10 to the worst, with 11 assigned to banks with no rating. The variable is used along with the dummy *Banks without Rating*, which takes the value of 1 for banks with no rating and 0 otherwise.[10] Both our proxies are imperfect measures of risk. *Ratings*, even excluding other questions, is generally available only for a subset of (large) banks. *Bad Loans* may be computed for each bank, but may be influenced by classification policies and it is not known with certainty by counterparts on a continuous time basis (as it is usually published only in the financial statements). We return on the point in our second econometric exercise.

The third key set of regressors $Bilateral_{jt}$ includes two variables related to the bilateral segment of the interbank market, which measure respectively the concentration and length of interbank relationships of each bank. The underlying idea is that the

[9]The methodology underlying this proxy for risk aversion is described in Jackwerth (2000) and implemented by Tarashev, Tsatsaronis and Karampatos (2003). As noted by Angelini et al. (2011), this variable should be able to capture a generalized increase in risk aversion among market participants (an important explanatory factor of the rising spread between unsecured and secured transactions according to their results), an aspect possibly affecting the choice of the market segment where intermediaries borrow their interbank funds. As we had this variable available only up to May 2012, we forecast it for the last months in our sample period by using the VSTOXX, the index based on EURO STOXX 50 options prices according to VIX methodology, which is closely correlated with our UNC indicator for the overlapping periods; results do not change with respect to those obtained using data only until May 2012.

[10]The credit scores are taken from the agency Fitch through the database of Bloomberg as Angelini et al. (2011) find that Fitch ratings are more informative in the assessment of banks and financial firms. All the credit ratings are obtained as a monthly average of ratings available daily. We use the overall individual rating.

existence of strong and long interbank relationships may deeply affect the incentives to operate via CCPs rather than bilaterally. [11] The first variable, Interbank Counterparties Concentration (ICC), measures the degree of concentration of bilateral interbank borrowing of a bank j in period t. [12] This variable, which ranges between 0 and 1 by definition, provides a measure of the strength of interbank relationships of each bank j, with higher values suggesting that bank j tend to hold more exclusive relationships with few counterparts. The second variable, Interbank Relationship Duration (IRD), measures in each period the weighted average length of all interbank relationships of each bank.[13].

In addition to the three previous key sets of regressors, further bank-specific covariates KR_{jt} are included, basically as control variables. *Retail Fundraising*, *Foreing Interbank Debts* and *Central Bank Loans* describe banks funding sources alternative to the CCPs. *Tier1* and *RoE* describe respectively bank capitalization and profitability, while *Size*, *Loans to Private Sector*, and *Portfolio of Government Bonds* roughly describe important aspects of a bank's business model. The last variable also provides a rough proxy for collateral availability (as central clearing allows for the multilateral netting of exposures, a given level of risk protection can be achieved with a smaller amount of the collateral needed to operate on the repo market). Finally bank-specific dummies b_j are included to account for unobservable structural bank characteristics.

[11] The Banca d'Italia prudential supervisory reports, which we use as our main data source, provide monthly information on gross bilateral positions of each bank resident in Italy with each bank counterpart, domestic and foreign. We consider all *extra-group* secured and unsecured transactions executed both on regulated and over-the-counter markets. In order to eliminate the intra-group exposures, we used information on the identity of each counterpart and its group. For the banks that changed group during our sample period we traced the current group of affiliation in each period, and analysed their effective inter-group relationships in each period.

[12] It is computed applying the standard Herfindahl index, $\text{ICC}_{jt} = \sum_{i=1}^{N} s_{ijt}^2$, where s_{ijt} is the share of counterpart bank i as lending counterpart of bank j in time t, and N is the total number of banks lending to bank j in time t.

[13] The variable IRD is a weighted average to take into account the size of each exposure in addition to its length and it is defined as follows: $\text{IRD}_{jt} = \sum_{i=1}^{N} s_{ijt} * d_{ijt}$, where j, i, t, N, and s_{ijt} are defined as before and d_{ijt} counts in each period t the integer number of consecutive months elapsed since the start of an interbank relationship between bank j and each counterpart bank i. In order to avoid as much as possible censoring, we collect data for this variable back to June 1998. The maximum value for the integer number d_{ijt} is accordingly equal to 181 in the last period of our sample if the pair (j,i) had a interbank relationship in any period (allowing for one month of interruption as a maximum: results are robust also two months of interruption and not allowing interruptions at all to consider a relationship as continuos). The weighted average duration amounts to 39 consecutive months on the lending side, and 27 months on the borrowing side. Censoring is not an issue once we computed the index with data back to 1998.

In our analysis, we distinguish among the two different phases of the financial crisis, to take into account that in some euro-area countries, including Italy, access to funding was difficult not only in the early stages of the crisis. We consider two crisis-related dummies. The dummy *CR1* covers the period from the Lehman Brothers bankruptcy in September 2008 to June 2011, when the sovereign crisis erupted in full force. The dummy *CR2* covers the sovereign crisis and runs until the end of the sample period. Monthly time dummies p_t are also typically included to take into account the impact of crisis-related events (such as the impact of a change in haircuts in November 2011 or the launch of the Long-Term Refinancing Operations by the ECB) as well as other unobservable time-varying variables.

Finally, our estimations need to take into account that most banks do not use the CCPs for their funding (especially during the first part of the sample period); the fact that our dependent variable is a ratio, the share of CCPs exposures over the total; and that determinants of zero and positive observations (once an intermediary decides to use CCPs) may be different. We adopt accordingly a zero inflated beta regression model, as suggested by Cook et al. (2008). This type of models is aimed to address the specification errors which may arise from modeling a ratio variable as a linear function of the explanatory variables and from ignoring that the conditional variance must be a function of the conditional mean since the former must change as the conditional mean approaches either 0 or 1. In addition, the zero inflated approach allows to take into account, avoiding the related selection bias, that the factors driving the choice to participate or not to CCPs may be qualitatively and/or quantitatively different from those influencing the intensity of the recourse to the CCPs, conditional on being a member. While most of the increase in the use of CCPs is driven in each year by the intensive margin, as expected, the data shows that between 2009 and 2010 and again between 2011 and 2013 also the contribution of the extensive margin (i.e. the funding obtained by banks which were not operating via CCPs the year before) is not irrelevant (Table 1).

[TABLE 1 ABOUT HERE]

Our second econometric exercise is aimed to further investigate the relative role of uncertainty and individual risk of an intermediary by including a measure that, in our view, may summarize their relative impact. The measure we propose to gauge the role of uncertainty and market discipline is the *change* in the weighted average duration of each intermediary's interbank relationships ΔIRD_{jt}, where IRD_{jt} is the Interbank

borrowing Relationship Duration for bank j at time t, defined above. In formal terms, we estimate the following equation by means of a fixed effect panel estimation model:

$$\Delta SH_{jt} = \alpha_0 UNC_t + \beta_0 Risk_{jt} + \gamma_0 \Delta IRD_{jt} + \gamma_1 \Delta IRD_{jt} * Risk_{jt} + \delta\prime KR_{jt} + \zeta\prime b_j + \eta\prime p_t + \epsilon_{jt} (2)$$

It can be argued that the variable ΔIRD_{jt} grasps the bank risk as it is perceived by its counterparts on the interbank market. Indeed, since the literature on relationship lending shows that long-lasting partnerships (more convincingly than strong but occasional relationships) are characterized by better information, if ΔIRD_{jt} grows this means that older relationships lengthen, sign that better informed counterparts remain in relation with the bank j. This would not only address the concern about the coarseness and/or the observability of the other measures of risks (ratings and bad loans), but it would be based precisely on the idea that the risk for the CCPs is to provide funding to borrowers that are reputed too risky by their bilateral counterparts. The intuition behind the choice of this indicator is the following. If the shift to CCPs is driven by a general increase of the uncertainty and risk-aversion, then longer-term relationships (interbank customer relationships) should be less affected. This should translate in a positive relationship between the change in CCP share and the change in duration of interbank relationships. Viceversa, if the shift to CCPs is dictated by the drying-up of interbank funding related to the specific riskiness of an intermediary this should affect proportionately more longer-term (customer) relationships as in this case older counterparts may reasonably be assumed to have better information than occasional counterparts on the intermediary[14]. In this case, ceteris paribus, the relationship between the change in CCPs share and the change in duration of interbank relationships should have a negative sign as recourse to CCPs should make up for the loss of relatively older relationships.

[14]About the role of market discipline in interbank markets, potentially favored by the fact that interbank deposits are not covered by deposit insurance schemes, there is a wide literature, both theoretical and empirical (e.g. Calomiris and Kahn, 1991; Rochet and Tirole, 1996; Furfine, 2001; Huang and Ratnovski, 2008; King, 2008; Distinguin et al, 2013). Angelini et al. (2011) summarized their results suggesting that in the pre-crisis period market discipline seems to have been absent, possibly due to the belief that an implicit central bank guarantee was in place, along the lines suggested by Rochet and Tirole. The rising role of the individual borrowers' conditions after the outbreak of the crisis was seen in this perspective as a possible sign of more market discipline.

3 Data

We focus, as large part of the literature on interbank markets does (e.g. Furfine, 2004 and 2009; King, 2008; Dinger and von Hagen, 2009; Cocco et al., 2009; Affinito, 2013), on outstanding interbank balances rather than on relative prices (in our case prices prevailing on CCPs transactions vis--vis the bilateral segments of the interbank market, either secured or unsecured) mainly because of data availability. Interest rates on over-the-counter interbank transactions are not available and, similarly, it is very difficult to summarize all the different aspects directly or indirectly involved in the relative cost (e.g., the haircuts, the cost of collateral, the contributions to the CCPs default funds, etc.). However, according to the majority of the accounts of the developments in interbank markets during the financial crisis, prices were basically moving in response to changes in quantities[15].

We consider monthly data from June 2004, when centrally cleared repo transactions were basically nil[16], to June 2013. With the exception of the variables *UNC* and *Ratings*, illustrated above, our data are basically drawn from the Banca d'Italia prudential supervisory reports and are available for each bank resident in Italy.[17] Data of intermediaries that are part of a banking group are consolidated at each point in time (considering the group as a single entity) as liquidity management is typically centralized at the group level and we are not considering infra-group transactions.[18] This is done for all variables in our dataset and in what follows we refer to both banking groups and stand-alone banks in our sample as "banks".

Our final sample is a panel including about 200 banks on average in each of our 109 monthly periods.[19] The banks in our sample represent on average about 90 per cent of the total assets of the Italian banking system along our sample period. Although

[15]The typical example were transactions on the e-MID, the electronic platform for unsecured interbank activity, where exchanges dramatically dropped, making the quoted prices basically non informative.

[16]Only one central counterparty is authorized in Italy, Cassa di compensazione e garanzia S.p.A. (CCG) but, thanks to interoperability arrangements, intermediaries dealing in instruments traded on different platforms (MTS, EuroMTS and BrokerTec) can belong either to CCG or to the French central counterparty LCH.Clearnet SA, as if the two partner institutions formed a single virtual central counterparty.

[17]We exclude from our analysis only cooperative banks which are typically very small and tend to manage their liquidity needs and surpluses through a dedicated intermediary which acts as a liquidity hub.

[18]We dropped the data on intra-group transactions because these transactions fit into a group-specific scheme, are likely to be decided by the parent bank, and are affected by group task-sharing (e.g. Houston et al., 1997; de Haas and van Lelyveld, 2010).

[19]The effective number of observations used in each regression is usually lower due to the lack of complete data for all the regressors.

interbank activity is usually at very short maturities, we use end-of-month outstanding amounts, in line with the majority of the literature, because data on most explanatory variables are not available on a more frequent basis. Tables 2 and 3 describe our explanatory variables and provides summary statistics.

[TABLES 2 AND 3 ABOUT HERE]

4 Results

The results of our first exercise are reported in Tables 4 and 5. Table 4 shows the results on the determinants of participation to CCPs (the dependent variable is a dummy 0,1), while Table 5 shows those related to the intensity of the recourse to CCPs conditional to participation (the dependent variable is a ratio). Starting from the factors underlying participation to CCPs transactions (Table 4), we find that stronger interbank bilateral relationships (the variable ICC) are associated with a lower participation[20], supporting the idea that the two channels tend to be alternative in normal conditions. During both phases of the crisis, however, this association tended to fade away, as also banks with established bilateral relationships had to tap all the available sources of funding, including the CCPs. Similar results hold when looking at the share of funding via CCPs (conditional to the participation to the market, Table 5): we again find that strong bilateral relationships reduce the need to resort to CCPs in normal conditions, but that this association disappeared during the crises. Similarly, we find that foreign extra-group interbank funding (as a ratio to total interbank funding) has a negative impact on CCPs participation (i.e. banks with higher bilateral funding from abroad are less likely to resort to CCPs, Table 4). As the financial crisis triggered a significant retrenchment of the foreign interbank bilateral funding (as shown above, Figure 4), we also use the change in funding from abroad as an explanatory variable and find that, as expected, a negative change in foreign funding is associated to a higher participation to CCPs transactions.

Moving to the role of market uncertainty, we find that this is not a significant factor in driving banks to CCPs until the start of the financial crisis. Then, for both the crisis periods, the coefficient associated to uncertainty becomes significant and associated with a larger participation and a larger share of CCPs transactions, likely reflecting the

[20] In the estimation of participation, a positive sign indicates a lower participation (more zeros) and a negative sign a higher participation (less zeros).

general move toward secured transactions at times of heightened risk aversion.[21]

Instead, the individual risk of a bank, as proxied either by the bad loans ratio or by the lack of a rating (for which results, not reported in Table 4, are broadly similar), affects both the participation and the intensive use of CCPs but in opposite directions. Participation of riskier banks to CCPs is more likely before the crisis and becomes instead less likely in both the two crisis periods, possibly due to the costs associated to participation by CCPs in a context of tighter risk control frameworks. By contrast, for banks already using CCPs, individual bank risk becomes a significant positive determinant of the proportion of CCPs transactions during the crisis (coefficients are significant in both sub-periods, slightly larger during the sovereign debt crisis phase), in line with the finding of an increased market discipline on other segments of the interbank market (Angelini et al., 2011).

In order to gain an insight into the estimated economic impact of the different determinants, Tables 4 and 5 also report the marginal effects of each regressor on the dependent variable other things being equal.[22] The total net impact of our measures of individual risk and general uncertainty are sizable and very similar. Moving from the 25th percentile to the 75th percentile of the bad debts ratio, participation increases by slightly less than one third before the crisis, but decreases by more than a third during the two periods of the crisis. Conversely, individual risk increases the intensity of the use of CCPs during the crisis with an impact ranging from 7 to 9 per cent in the two phases of the crisis. On the other hand, the uncertainty increases both the participation (in the two phases of the crisis by around 13 and 21 per cent, respectively) and the share of CCP transactions (during the sovereign part of the crisis by around 15 per cent).

As for the other covariates, we find that larger banks tend to participate more to CCPs, consistently with the direct and indirect costs associated to the membership of CCPs, and that the share of centrally cleared transactions is higher for banks with a higher share of government bond over total assets (used as a proxy of collateral availability).

The results of this first exercise provide a broad view of the factors driving participation and recourse to CCPs transactions before and during the financial crisis, confirming

[21] To support this interpretation, we ran a similar regression for the asset side, as uncertainty is likely to be a factor first of all for lenders concerned about the counterparty risk, finding that the participation to CCPs is indeed higher when our measure of general uncertainty is higher and when the degree of concentration of bilateral lending is lower.

[22] The marginal effect is computed first averaging the coefficients across the specifications 5-9 and then measuring the percentage change of the dependent variables moving from the 25th to the 75th percentile of each regressor.

that both uncertainty and risk play a significant role. To try to shed more light on the relative role of the two factors, we run a second exercise based on the change over time of the weighted average duration of bilateral interbank relationships of each bank ΔIRD_{jt}. As argued above, if the shift to CCPs is driven by a general increase of the uncertainty, then longer-term relationships should be less affected, and we should find a positive relationship between ΔIRD_{jt} and ΔSH_{jt}. Viceversa, if the shift to CCPs derives from a bank specific riskiness, this should involve more longer-term relationships because in this case older (better informed) counterparts should quit first and recourse to CCPs should make up for them: therefore in this case the relationship between ΔIRD_{jt} and ΔSH_{jt} should be negative.

Table 6 summarizes the results obtained in this exercise. It shows, first, that changes in the use of CCPs are negatively related to changes in the weighted average duration but that this effect holds only during the crisis (specifications 1-2). Moreover, in line with our hypothesis, the driver of this result is the level of individual risk, as indicated by the significance of the interaction term alone (specifications 3-4). As the relationship should became (more) negative as we move from the lowest to the highest level of banks' riskiness, if our interpretation of the weighted average duration variable is correct, our results are supportive of it. We finally interact the changes in the weighted average duration with quartiles (deciles) of our risk indicator (bad loans ratio) showing that the effect is concentrated only in the highest deciles of the distribution by risk (the last two deciles in the first part of the crisis and the last one only in the sovereign debt crisis). For the riskier borrowers, therefore, the negative and significant sign of the average duration suggests that the driver of the increased recourse to the CCPs is the loss of more established interbank customer relationships, a signal that there may be a specific issue with the riskiness of the intermediary and CCPs may be used as a substitute source. At the same time, this result shows that this determinant of the recourse to CCPs holds only for the riskiest segment of the banking populations.

5 Conclusions

During the crisis Italian banks remarkably increased their use of CCPs for their funding. The financial stability implications of this growing role of CCPs may be rather different according to the underlying driving factors: on the one side it may reduce uncertainty and avoid the freezing of the interbank market; on the other side, it may allow riskier borrowers to escape market discipline increasing the counterparty risk borne by CCPs and as a consequence by the financial system as a whole. Overall, our analysis confirms

that uncertainty and bank risk are both drivers of the recourse to CCPs. Our findings suggest that only for the riskier borrowers the recourse to the CCPs during the crisis is likely driven by difficulties to borrow in the bilateral interbank market due to their risk; for all the other banks, the recourse to CCPs is rather due to the impact on the bilateral segment of the general increase in uncertainty and risk aversion suggesting that overall CCPs played a useful role, providing an additional funding channel.

Figure 1. Interbank exposures through CCPs as shares of total assets

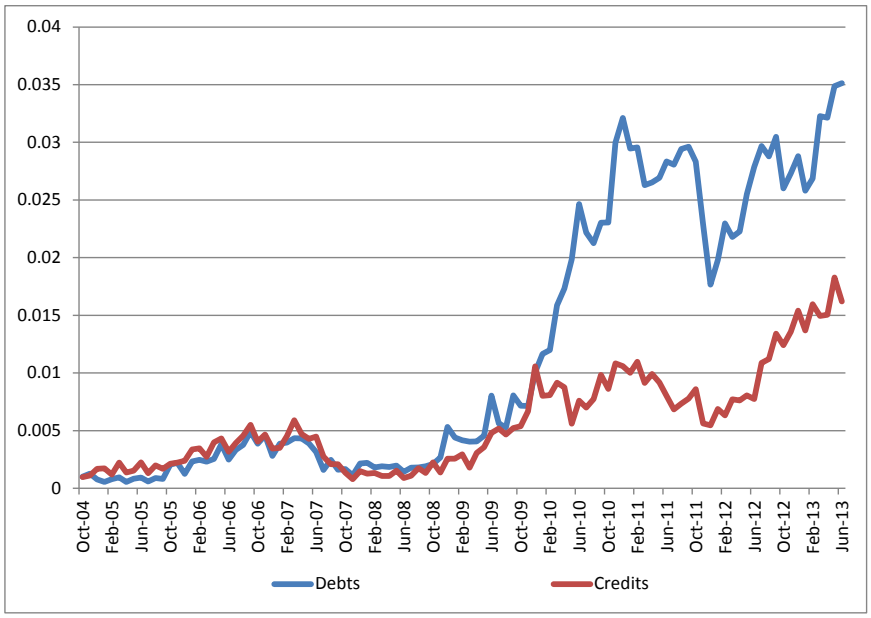

Figure 2. Interbank exposures through CCPs as shares of total extra-group interbank exposures

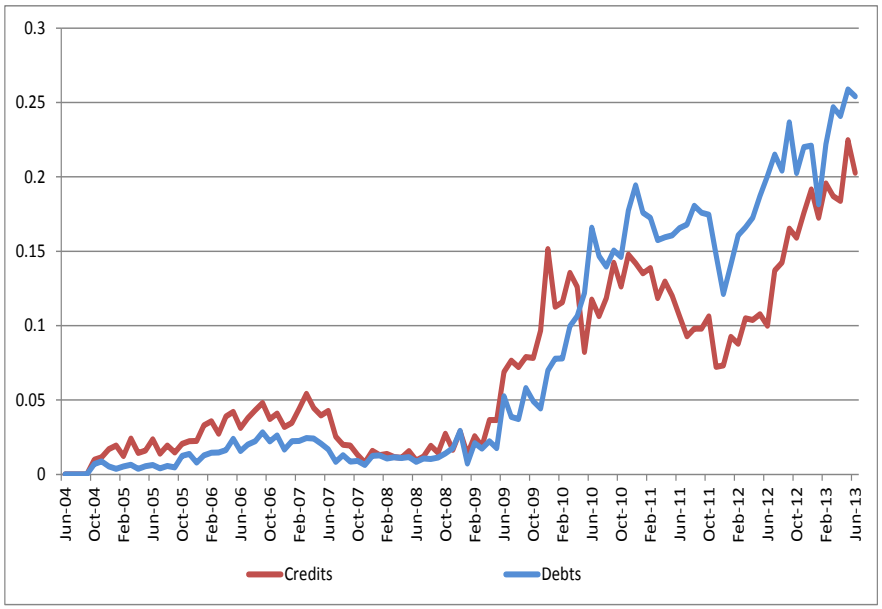

Figure 3. The number of banks operating via CCPs as a share of the total number of banks operating in the extra-group interbank markets

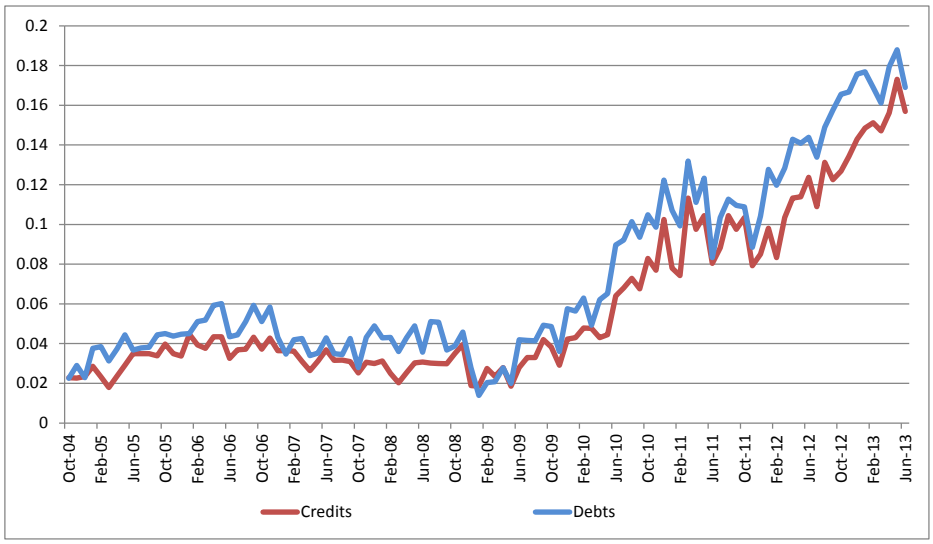

Figure 4. Interbank exposures through CCPs and abroad as shares of total assets

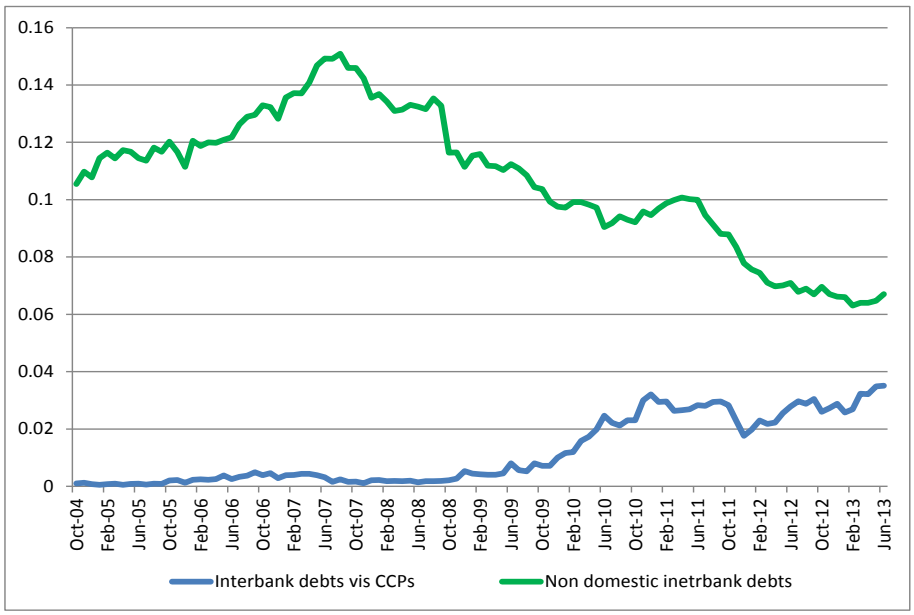

Table 1

Intensive and extensive margins of interbank exposures through CCPs
(*millions of euros and as a share of total assets*)

	total		**intensive**		**extensive**	
		%		%		%
2009 - 2008	10,955	*0.31*	10,923	*0.31*	32	*0.00*
2010 - 2009	52,841	*1.53*	46,741	*1.36*	6,100	*0.18*
2011 - 2010	20,602	*0.59*	20,209	*0.58*	393	*0.01*
2012 - 2011	-885	*-0.02*	-4,033	*-0.11*	3,148	*0.09*
2013 - 2012	17,246	*0.45*	13,726	*0.36*	3,521	*0.09*
2013 - 2008	**100,759**	***2.64***	**87,564**	***2.29***	**13,194**	***0.35***

The extensive margin is computed as the sum of the current year average interbank exposure through CCPs of each bank whose previous year average interbank exposure through CCPs is equal to zero. The intensive margin is computed as the sum of differences of the current and previous year average interbank exposures of each bank whose previous year average interbank exposure through CCPs is larger than zero.

Table 2. Definition of variables and summary statistics

Name	Definition	N	mean	sd	min	p50	max
CCP Debts	Interbank debts through CCPs / Total interbank debts	15,279	0.02	0.10	0.00	0.00	1.00
Foreign interbank debts	Interbank debts from abroad / Total interbank debts	15,279	0.20	0.32	0.00	0.02	1.00
Borrowing IRD	Weighted average length of all interbnk borrowing relationships	15,279	2.80	1.50	0.00	3.28	5.14
Borrowing ICC	Log (degree of concentration of interbank debts)	15,279	0.44	0.36	0.00	0.34	1.00
Size	Log (Total assets)	15,279	7.79	1.96	1.95	7.72	13.67
Loans to Private Sector	Loans to Private Sector / Total Assets	15,279	0.57	0.24	0.00	0.63	0.99
Portfolio of Government Bonds	Portfolio of Government Bonds / Total Assets	15,279	0.06	0.09	0.00	0.03	0.86
Retail Fundsraising	Total retail deposits and bonds / Total assets	15,279	0.47	0.30	0.00	0.57	1.00
Central Bank loans	Total loans form central bank / Total Assets	15,279	0.02	0.05	0.00	0.00	0.36
Bad loans	Bad loans / Total loans	15,279	0.03	0.03	0.00	0.02	0.12
Tier1	Tier1 / Risk weighted assets	11,606	0.17	0.13	0.02	0.13	1.00
ROE	Net profits / Capital	15,279	0.06	0.17	-0.89	0.05	0.90
Rating	Rating agency scores	15,279	9.87	2.47	2.00	11.00	11.00
Banks without rating (0-1)	Banks without rating (0-1)	15,279	0.82	0.38	0.00	1.00	1.00

Table 3. Correlations among variables

	CCP Debts	Foreign interbank debts	Borrowing IRD	Borrowing ICC	Size	Loans to Private Sector	Portfolio of Government Bonds	Retail Fundsraising	Central Bank loans	Bad loans	Tier1	ROE	Rating	Banks without rating (0-1)	UNC
CCP Debts	1														
Foreign interbank debts	-0.1006*	1													
Borrowing IRD	0.1298*	-0.4002*	1												
Borrowing ICC	-0.0826*	-0.0759*	0.0952*	1											
Size	0.2668*	-0.0392*	0.4191*	-0.2902*	1										
Loans to Private Sector	-0.1284*	0.1565*	0.0304*	0.0197	-0.0826*	1									
Portfolio of Government Bonds	0.1710*	-0.3526*	0.0809*	0.0945*	-0.0564*	-0.2945*	1								
Retail Fundsraising	0.0427*	-0.7506*	0.2858*	0.0707*	0.0612*	-0.0022	0.3431*	1							
Central Bank loans	0.1963*	-0.1507*	0.1382*	-0.019	0.1617*	-0.1766*	0.3583*	0.0003	1						
Bad loans	0.1106*	-0.3399*	0.2825*	0.0240*	0.1757*	0.1950*	0.1354*	0.3106*	0.1463*	1					
Tier1	0.0618*	-0.0807*	-0.2605*	0.1087*	-0.2841*	-0.3920*	0.1297*	-0.2893*	0.0399*	-0.1302*	1				
ROE	-0.0808*	0.1930*	-0.0022	-0.0782*	0.0940*	0.1871*	-0.0810*	-0.1182*	-0.0637*	-0.0859*	-0.2006*	1			
Rating	-0.1642*	0.2199*	-0.2966*	0.2550*	-0.5746*	0.0726*	-0.0204	-0.1524*	-0.0897*	-0.2252*	0.1385*	-0.0161	1		
Banks without rating (0-1)	-0.1757*	0.2225*	-0.3002*	0.2528*	-0.5728*	0.0738*	-0.0086	-0.1463*	-0.0850*	-0.2485*	0.1381*	-0.0092	0.9742*	1	
UNC	0.0751*	0.0215*	-0.0775*	0.0165	-0.0176	0.0354*	0.0279*	-0.0258*	0.1221*	0.0705*	0.0472*	-0.1078*	0.0765*	0.0673*	1

* denote statistical significance at 10 % level.

Table 4. Determinants of interbank exposures through CCPs. First step: zeroinflate estimation results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	Marginal effects
Foreign interbank debts	29.372 ***	29.296 ***	31.281 ***		28.257 ***	28.619 ***	28.885 ***			22.5
	9.117	*8.995*	*11.089*		*8.268*	*8.065*	*9.427*			
Delta (foreign interbank debts)				6.925 **				7.577 **	14.173 ***	1.3
				3.241				*3.543*	*4.488*	
UNC	3.604 **	2.604	4.704 *	4.713 **	3.513	2.983	5.279 *	3.954	2.769	9.3
	1.543	*1.826*	*2.614*	*1.831*	*2.877*	*2.371*	*3.180*	*3.034*	*2.065*	
UNC x crisis 1					-3.474 *	-6.093 ***	-3.701 ***	-3.733	-2.362 ***	-13.2
					2.087	*1.730*	*1.429*	*2.389*	*0.732*	
UNC x crisis 2					-5.715 **	-8.240 ***	-5.781 **	-5.968 **	-4.539 ***	-21.3
					2.390	*2.004*	*2.292*	*2.617*	*1.143*	
ICC	3.510 ***	3.940 ***		4.089 *	8.051 ***	8.345 ***		8.250 ***	7.285 **	43.8
	1.330	*1.410*		*1.701*	*2.525*	*2.714*		*2.531*	*3.170*	
ICC x crisis 1					-5.577 **	-5.208 **		-5.527 **	-5.204 *	-32.0
					2.402	*2.417*		*2.257*	*3.248*	
ICC x crisis 2					-5.540 **	-5.421 *		-5.310 **	-4.524	-30.8
					2.721	*2.825*		*2.470*	*3.255*	
IRD	0.072		0.121	0.180	0.554		0.316	0.737		ns (1.4)
	0.177		*0.161*	*0.178*	*0.556*		*0.355*	*0.613*		
IRD x crisis 1					-0.432		-0.259	-0.505		ns (-1.8)
					0.789		*0.681*	*0.799*		
IRD x crisis 2					-0.478		-0.157	-0.582		ns (-1.3)
					0.599		*0.437*	*0.638*		
Bad loans	0.121	0.555	1.455	-5.391	-74.133 **	-53.878 *	-40.811 **	-88.955 **	-83.777 **	-31.1
	16.099	*14.094*	*12.543*	*15.185*	*30.873*	*30.244*	*19.594*	*37.926*	*35.374*	
Bad loans x crisis 1					76.181 ***	58.478 **	60.182 ***	83.550 **	85.862 **	34.0
					27.454	*26.642*	*22.615*	*35.108*	*33.891*	
Bad loans x crisis 2					87.453 ***	71.118 **	65.933 ***	99.470 **	91.362 **	38.2
					31.551	*30.413*	*24.623*	*38.703*	*37.325*	
Size	-2.772 **	-3.103 **	-2.960 **	-3.015 **	-2.355 ***	-2.551 **	-2.780 **	-2.297 **	-0.998	-39.6
	1.177	*1.358*	*1.347*	*1.490*	*0.920*	*0.998*	*1.324*	*0.893*	*1.325*	
Retail Fundsraising	-8.753 ***	-9.549 ***	-9.505 ***	-8.542 ***	-6.666 **	-7.713 **	-6.755 **	-6.511 *	-4.651	-27.5
	3.072	*3.179*	*3.434*	*3.584*	*3.363*	*3.274*	*3.416*	*3.827*	*3.644*	
Loans to Private Sector	8.517 *	7.962 *	7.652 *	8.217 *	11.691 ***	11.498 **	8.336 *	11.919 ***	15.654 ***	34.3
	4.859	*4.929*	*4.716*	*4.850*	*4.464*	*4.812*	*4.635*	*4.168*	*4.430*	
Central Bank loans	7.848	8.490	5.753	5.495	5.764	6.947	4.591	3.423	4.219	ns (3.4)
	9.806	*9.819*	*9.464*	*9.864*	*9.804*	*9.848*	*9.409*	*9.627*	*9.460*	
Portfolio of Government Bonds	-0.863	-0.762	-0.202	-1.775	-0.880	-0.680	-1.868	-2.088	-2.896	ns (-1.7)
	5.479	*5.494*	*4.928*	*6.178*	*5.632*	*5.708*	*6.245*	*6.122*	*5.800*	
ROE	0.725	0.705	1.489	0.859	0.284	0.523	1.357	0.471	-0.202	ns (4.4)
	1.250	*1.181*	*1.311*	*1.153*	*1.271*	*1.273*	*1.332*	*1.247*	*1.449*	
Constant	28.862 **	38.277 **	32.536 **	33.971 **	24.817 **	32.157	30.773 *	26.889 **	7.738	
	14.173	*16.841*	*15.783*	*17.651*	*12.240*	*13.367*	*16.178*	*12.519*	*16.414*	
Number of observations	13,732	15,279	13,766	13,729	13,732	15,279	13,766	13,729	15,279	

Table reports zero inflated beta regression model results of the first step: factors driving the choice to participate or not to CCP. Observations are clustered at banking group level (and at bank level for independent banks), thus obtaining heteroskedasticity-robust standard errors and controlling for possible autocorrelations across the same banking group. Table reports regression coefficients, associated standard errors in italics, and marginal effects. In the estimation of participation, a positive sign indicates a lower participation (more zeros) and a negative sign a higher participation (less zeros). ***, **, and * denote statistical significance at 1, 5 and 10 % level. The marginal effect of each determinant is computed first averaging the coefficients across the specifications 5-9 and then measuring the percentage change of the dependent variable (the share of CCP exposures on total interbank exposures) moving from the 25th to the 75th percentile of each regressor.

Table 5. Determinants of interbank exposures through CCPs. Second step: proportion estimation results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	Marginal effects
Foreign interbank debts	-1.240	-0.879	-1.222		0.693	0.814	-1.166			ns (-2.5)
	1.647	*1.692*	*1.614*		*1.699*	*1.748*	*1.488*			
Delta (foreign interbank debts)				0.377				0.478	1.028	ns (0.1)
				1.354				*1.362*	*0.758*	
UNC	1.423	1.864	1.468	1.828 *	0.370	0.270	0.667	0.278	-0.782	ns (5.7)
	1.075	*5.974*	*1.074*	*0.933*	*1.220*	*7.388*	*1.174*	*1.143*	*11.510*	
UNC x crisis 1					0.565	0.434	0.560	0.582	0.320	ns (17.9)
					0.486	*1.422*	*0.487*	*0.472*	*5.222*	
UNC x crisis 2					0.487 *	0.336	0.534 **	0.510 *	0.218	15.3
					0.296	*1.697*	*0.213*	*0.290*	*5.604*	
ICC	0.013	0.017		-0.012	-3.175 ***	-2.847 ***		-2.939 ***	-2.133 **	-14.2
	0.303	*0.331*		*0.287*	*0.913*	*0.772*		*0.945*	*0.955*	
ICC x crisis 1					3.128 ***	2.683 ***		2.873 ***	2.047 **	13.8
					0.758	*0.658*		*0.836*	*0.976*	
ICC x crisis 2					3.423 ***	3.131 ***		3.188 ***	2.441 **	15.5
					0.952	*0.835*		*1.031*	*1.005*	
IRD	0.112		0.113	0.104	0.212		-0.226	0.226		ns (1.8)
	0.098		*0.099*	*0.102*	*0.235*		*0.288*	*0.253*		
IRD x crisis 1					0.024		0.493	0.012		ns (3.0)
					0.271		*0.318*	*0.286*		
IRD x crisis 2					-0.170		0.279	-0.182		ns (-1.4)
					0.260		*0.313*	*0.275*		
Bad loans	15.394 ***	16.063 ***	15.398 ***	15.444 ***	-6.258	-2.149	-5.733	-6.315	-16.191	ns (-3.0)
	3.515	*3.361*	*3.598*	*3.457*	*10.723*	*9.875*	*10.684*	*10.674*	*10.377*	
Bad loans x crisis 1					14.540 *	12.668 *	14.819 **	14.561 *	21.141 **	6.7
					7.940	*7.477*	*7.293*	*7.939*	*8.589*	
Bad loans x crisis 2					19.697 **	17.805 **	18.957 **	19.767 **	28.272 ***	9.0
					9.758	*8.896*	*9.501*	*9.681*	*9.692*	
Size	-0.541	-0.582	-0.552	-0.689 *	-0.232	-0.219	-0.354	-0.207	0.061	ns (-4.2)
	0.578	*0.564*	*0.565*	*0.411*	*0.654*	*0.591*	*0.676*	*0.581*	*0.620*	
Retail Fundsraising	0.016	0.086	0.020	0.081	0.223	0.279	0.193	0.222	-0.106	ns (6.3)
	0.920	*0.832*	*0.930*	*0.947*	*0.941*	*0.877*	*0.945*	*0.930*	*0.927*	
Loans to Private Sector	-1.252	-1.342	-1.269	-1.680	0.100	0.101	-0.119	0.217	0.357	ns (3.5)
	2.215	*2.173*	*2.210*	*1.821*	*2.271*	*2.151*	*2.446*	*2.090*	*2.166*	
Central Bank loans	1.114	1.349	1.120	1.053	1.342	1.683	1.194	1.382	1.584	ns (1.0)
	1.729	*1.793*	*1.727*	*1.672*	*1.580*	*1.688*	*1.678*	*1.597*	*1.602*	
Portfolio of Government Bonds	5.954 ***	5.916 ***	5.968 ***	6.097 ***	6.325 ***	6.238 ***	6.179 ***	6.284 ***	6.303 ***	5.6
	1.349	*1.403*	*1.271*	*1.339*	*1.333*	*1.405*	*1.247*	*1.303*	*1.505*	
ROE	0.016	0.044	0.018	0.016	0.193	0.193	0.236	0.199	0.168	ns (1.9)
	0.380	*0.404*	*0.360*	*0.383*	*0.357*	*0.369*	*0.351*	*0.359*	*0.341*	
Constant	1.811	1.084	1.933	3.521	-0.606	-0.565	0.470	-0.925	-1.965	
	7.041	*0.754*	*6.910*	*4.926*	*7.688*	*0.754*	*8.049*	*6.853*	*1.754*	
Number of observations	13,732	15,279	13,766	13,729	13,732	15,279	13,766	13,729	15,279	

Table reports zero inflated beta regression model results of the second step: factors inuencing the intensity of the recourse to the CCPs, conditional on being a member. Observations are clustered at banking group level (and at bank level for independent banks), thus obtaining heteroskedasticity-robust standard errors and controlling for possible autocorrelations across the same banking group. Table reports regression coefficients, associated standard errors in italics, and marginal effects. ***, **, and * denote statistical significance at 1, 5 and 10 % level. The marginal effect of each determinant is computed first averaging the coefficients across the specifications 5-9 and then measuring the percentage change of the dependent variable (the share of CCP exposures on total interbank exposures) moving from the 25th to the 75th percentile of each regressor.

Table 6. Determinants of Δ(interbank exposures through CCPs)

	(1)		(2)		(3)		(4)		(5)		(6)	
Foreign interbank debts	0.010		0.012		0.015		0.016		0.017		0.023	
	0.043		*0.043*		*0.043*		*0.043*		*0.044*		*0.040*	
UNC	-0.004		-0.003		-0.004		-0.004		-0.009		0.024	
	0.006		*0.006*		*0.006*		*0.006*		*0.008*		*0.018*	
Size	0.031	***	0.030	***	0.031	***	0.031	***	0.029	***	0.017	**
	0.009		*0.009*		*0.009*		*0.009*		*0.009*		*0.008*	
Retail Fundsraising	0.056		0.055		0.056		0.057		0.062		0.038	
	0.086		*0.085*		*0.086*		*0.085*		*0.086*		*0.081*	
Loans to Private Sector	0.003		-0.004		0.003		0.001		-0.004		-0.028	
	0.040		*0.040*		*0.040*		*0.040*		*0.040*		*0.043*	
Central Bank loans	0.041		0.041		0.041		0.042		0.022		-0.009	
	0.086		*0.084*		*0.085*		*0.085*		*0.083*		*0.084*	
Portfolio of Government Bonds	0.352	***	0.345	***	0.349	***	0.349	***	0.336	***	0.378	***
	0.129		*0.127*		*0.129*		*0.128*		*0.127*		*0.135*	
ROE	-0.018		-0.017		-0.018		-0.018		-0.013		-0.016	
	0.013		*0.013*		*0.013*		*0.013*		*0.013*		*0.012*	
Δ(IRD)	-0.004	**	0.002		-0.001		-0.001		0.002		0.003	
	0.002		*0.002*		*0.003*		*0.003*		*0.003*		*0.003*	
Δ(IRD) x crisi 1			*-0.004*	*					*0.001*		*-0.001*	
			0.002						*0.002*		*0.002*	
Δ(IRD) x crisi 2			*-0.017*	**					*-0.003*		*-0.007*	*
			0.007						*0.003*		*0.004*	
Bad loans	0.316		0.302		0.336		0.348		-0.039			
	0.243		*0.242*		*0.244*		*0.244*		*0.252*			
Bad loans x crisi 1									*0.253*			
									0.185			
Bad loans x crisi 2									*0.486*	*		
									0.288			
Δ(IRD) x Bad loans					*-0.162*	*	*0.029*					
					0.085		*0.085*					
Δ(IRD) x Bad loans x crisi 1							*-0.162*	*				
							0.084					
Δ(IRD) x Bad loans x crisi 2							*-0.335*	**				
							0.159					
Δ(IRD) x Bad loans (2° quartile) x crisi 1									-0.004			
									0.007			
Δ(IRD) x Bad loans (2° quartile) x crisi 2									-0.024			
									0.021			
Δ(IRD) x Bad loans (3° quartile) x crisi 1									-0.002			
									0.005			
Δ(IRD) x Bad loans (3° quartile) x crisi 2									-0.016			
									0.013			
Δ(IRD) x Bad loans (4° quartile) x crisi 1									-0.012	*		
									0.006			
Δ(IRD) x Bad loans (4° quartile) x crisi 2									-0.021	*		
									0.012			
Δ(IRD) x Bad loans (7° decile) x crisi 1											0.002	
											0.005	
Δ(IRD) x Bad loans (7° decile) x crisi 2											0.006	
											0.007	
Δ(IRD) x Bad loans (8° decile) x crisi 1											0.011	
											0.007	
Δ(IRD) x Bad loans (8° decile) x crisi 2											*-0.027*	
											0.037	
Δ(IRD) x Bad loans (9° decile) x crisi 1											*-0.024*	**
											0.011	
Δ(IRD) x Bad loans (9° decile) x crisi 2											-0.004	
											0.008	
Δ(IRD) x Bad loans (10° decile) x crisi 1											*-0.017*	**
											0.008	
Δ(IRD) x Bad loans (10° decile) x crisi 2											*-0.032*	*
											0.016	
Constant	-0.287	***	-0.278	***	-0.287	***	-0.289	***	*-0.266*	***	*-0.160*	**
	0.075		*0.072*		*0.074*		*0.074*		*0.075*		*0.069*	
Rho	0.37		0.36		0.37		0.38		*0.355*		*0.323*	
Number of observations	11,008		11,008		11,008		11,008		11,008		11,008	

Table reports fixed effects panel results, where fixed effects are for banks; time fixed effects also are always included. Observations are clustered at banking group level (and at bank level for independent banks), thus obtaining heteroskedasticity-robust standard errors and controlling for possible autocorrelations across the same banking group. Partial interaction terms are always included even if unreported; in specification (6), the other deciles' results are not reported. Table reports regression coefficients and associated standard errors in italics. ***, **, and * denote statistical significance at 1, 5 and 10 % level.

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