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Loss absorption capacity of central counterparties. Evidence from EU-authorised CCPs – part I

Weronika Rec*

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Abstract

The aim of this study was to investigate loss absorption capacity of central counterparties. The qualitative and quantitative analysis was based on PQD data provided by 15 EU-authorised CCPs for Q4 2015–Q4 2017. Certain indicators were proposed in order to delineate the empirical structure of CCPs' default waterfalls and to assess the viability and stability of CCPs. The main conclusion of the analysis is that in order to incentivise clearing participants as much as possible towards prudent risk management, the structure of default waterfall should be modified.

Keywords: CCP, central clearing, default waterfall, financial stability, liquidity risk

JEL: G01, G15, G18, G23, L14

* Warsaw School of Economics, Collegium of Management and Finance; e-mail: weronika.rec@gmail.com.

1 Introduction

In recent decades, progressive disintermediation and the increasing volume of international trade contributed largely to a constant gain in popularity of global financial markets, whose rapidly developing market segments included over-the-counter (OTC) derivatives (Głogowski 2012; Gregory 2014). Despite their controversial role before and during the 2007–2009 crisis, it is worth noticing that OTC derivatives did not contribute to the crisis directly, however, they affected the scope and direction of the effects of market turbulences. The main reason behind this development was the traditional information asymmetry, lack of transparency and low investor protection characterising this market segment. All those features led to the opacity of OTC derivatives market, which combined with incredibly high interconnectedness and concentration of risk exposure led to the materialisation of systemic risk and inflamed the recent financial crisis (Moloney 2014).

To ensure financial stability and the viability of the whole system, certain measures were proposed in the aftermath of the crisis, aimed at overcoming imperfections of the market and helping mitigate systemic risk. The G20 and European regulators started to notice a need for combating the weaknesses of global financial markets and dealing with potential threats. At first, the proposals were formed in the Report of the High-Level Group on Financial Supervision in the EU, issued in February 2009 and commonly known as the de Larosière Report. Then, in September 2009, a G20 summit followed where the Leaders Statement, serving as a trigger for the reforms of global financial markets, was pronounced. In both the attempts to build guidelines for the future regulatory movement, it was emphasised that global economy was in a critical condition that was driven more or less by the irresponsibility of financial institutions: "We meet in the midst of a critical transition from crisis to recovery to turn the page on an era of irresponsibility and to adopt a set of policies, regulations and reforms to meet the needs of the 21st century global economy." (G20 2009). The need for improving the OTC derivatives market was justified by the fact that excessive risk, dubbed by the Leaders as irresponsible and reckless, had been taken by banks and financial institutions. The Leaders emphasised that coming back to such a level of risk was out of the question. Therefore, the key point of the Leaders Statement was that by the end of 2012 all standardised OTC derivatives should be cleared through central counterparties.[1]

One of the element of the global reform of OTC derivatives market, which in the EU took a form of new regulations, is the European Market Infrastructure Regulation (EMIR),[2] which came into force in 2012 and introduced the mandatory central clearing of OTC derivatives in the EU. The initiative will be discussed in the present paper later on.

Generally the concept assumes that a central counterparty (CCP) interposes itself between both sides of a derivative contract and becomes the buyer for the original seller and the seller for the original buyer. The tool at a CCP's disposal which allows it to withstand losses in the case of a default of any of the original counterparties is the default waterfall (DW). By and large, this mechanism consists of several layers of financial resources that are used in a specific order to absorb losses.

[1] It is worth to compare it with the statement in the de Larosière Report: "The crisis has revealed that there will be a need to take a wide look at the functioning of derivative markets. The simplification and standardisation of most over-the--counter (OTC) derivatives and the development of appropriate risk-mitigation techniques plus transparency measures could go a long way towards restoring trust in the functioning of these markets" (de Larosière 2009).

[2] Regulation (EU) No. 648/2012 of the European Parliament and of the Council of 4 July 2012 on OTC derivatives, central counterparties and trade repositories, O. J. L 201/1.

Mandatory central clearing means certain conveniences for the market as a whole, however, as they seem to be of the same calibre as inconveniences, it is difficult to determine whether benefits outweigh the costs. Indeed, Duffie and Zhu (2011) notice that by moving bilateral transactions to the CCP, the overall volume of counterparty credit exposures is reduced. This view is also shared in Heller and Vause (2012), Koeppl and Monnet (2013), Cont (2015). In this connection Bellia et al. (2017) conclude that the ability to reduce credit counterparty risk is an important incentive to centrally clear the contract. In this aspect the central clearing obligation may be regarded as a kind of insurance policy – trading parties pay for being protected against the default of their counterparties. Hence, CCP can be regarded as a tool for risk sharing (Hull 2012). In addition, as noticed in Cont (2015), by becoming an intermediary the CCP breaches direct links between original counterparties and contributes positively to limiting interconnectedness and thereby alleviates systemic risk. What, however, is the most significant benefit, is that due to its construction central clearing enables multilateral netting, which means that transactions are netted rather than settled individually and that each counterparty pays its aggregated obligations towards others on a net basis only. In this connection, clearing participants do not need to provide as much resources as in the case of bilateral clearing of each transaction, which automatically implies lower demand for liquidity. Central clearing may also be a better choice for clearing participants in terms of costs when compared with bilateral clearing, as under the Capital Requirements Regulation[3] it implies lower capital requirements (BIS 2014). However, some claim that it may not be as costs-redundant as it is widely believed (Koeppl, Monnet 2013; Ghamami, Glasserman 2017; Singh, Turing 2018). Another major improvement is that the whole solution contributes positively to increased market transparency and lower information asymmetry, as it is possible to follow each particular link cumulated in the CCP (Koeppl, Monnet 2013). Finally, due to the severe requirements (for CCPs and clearing members alike) mandatory central clearing enforces prudent risk management.

As for disadvantages, despite some ensuing cost reductions, it is worth noticing that participation in central clearing requires clearing participants to contribute to the default waterfall of CCPs, which is discussed in detail in further sections and which more or less entails a need to provide a highly liquid collateral and to pay clearing fees (Koeppl, Monnet 2013). That automatically means that clearing participants bear opportunity costs, which in the case of long maturities of concluded contracts may be painful for market entities and lead to weakening liquidity (Koeppl, Monnet 2013). The European Commission argues that central clearing obligation may impose excessive costs, especially on smaller financial counterparties and non-financial counterparties which use OTC derivatives mainly for hedging purposes and whose costs (clearing fees, costs resulting from the reporting obligation), are therefore disproportionate to their activity.[4] Central clearing also leads to increased procyclicality, as noticed by Lin and Surti (2015).

Last but not least, another threat is risk concentration by CCPs (Wendt 2015). It means that by providing clearing services a CCP concentrates multiple counterparties in a single node and becomes a systemically important financial institution (SIFI). Actually, by lowering credit counterparty risk

[3] Regulation (EU) No. 575/2013 of the European Parliament and of the Council of 26 June 2013 on prudential requirements for credit institutions and investment firms and amending Regulation (EU) No. 648/2012, O. J. L 176/1.

[4] This is the main reason why in the European Union the review of EMIR, the so-called EMIR Refit, is being prepared. For further details see: Proposal for a Regulation of the European Parliament and of the Council amending Regulation (EU) No. 648/2012 as regards the clearing obligation, the suspension of the clearing obligation, the reporting requirements, the risk mitigation techniques for OTC derivatives contracts not cleared by a central counterparty, the registration and supervision of trade repositories and the requirements for trade repositories, May 2017, COM (2017) 208 final, 2017/0090 (COD).

a CCP does contribute to systemic risk mitigation, however, at the same time it exacerbates that kind of risk. This ambiguity and the impossibility to unambiguously assert whether a CCP can mitigate systemic risk or not, are caused by various factors.

First of all, systemic risk is a varying quantity over time and there are various entities contributing to it. According to Smaga (2014), it stems from risks arising from the behaviour and activities of institutions, such as taking on excessive risk and its improper valuation, high leverage, moral hazard, etc., whose aggregated impact contributes to the rise in systemic risk over time. These institutions by definition are large banks, other financial institutions and entities that provide non-substitutional services, such as central clearing, etc. Mülbert (2015), in turn, concludes that another crucial trigger for systemic risk is the interconnectedness that stems from contractual ties. Assuming that each link means a trade cleared, which simultaneously creates more opportunities for multilateral netting, a high number of interconnections helps disperse credit counterparty risk. However, it also contributes to magnifying systemic risk because of proportionally more possibilities for shock spreading and higher quantum of risk controlled by the CCP (Cruz Lopez, Manning 2017). In addition, by the mechanism of central clearing CCPs cumulate multiple connections involving clearing members, settlement banks, investment counterparties, lenders and other CCPs. The cumulation is further intensified by each particular connection between a clearing member and its clients. Manning and Hughes (2016) go as far as to indicate that the systemic importance of CCPs is derived not only from its participants but also stems from its lack of substitutability. FSB et al. (2018) give a further insight into interdependencies among CCPs.

By such a concentration the CCP becomes another too-important-to-fail (TITF) institution. Its failure would result in dramatic turbulences even worldwide, hence, CCPs create incentives for moral hazard which may cause a CCP to take on excessive risk in the conviction that in the case of any severe turbulences, it will be bailed-out by the state (Singh 2011; Elliot 2013; Wendt 2015). This casts a shadow over the whole solution since state aid means the involvement of tax-payers.

On the other hand, regulators have equipped CCPs with a unique toolkit in the form of the default waterfall mechanism. The uniqueness of the DW means that only CCPs are entitled to use such a tool, which due to the obligatory contribution of each clearing member should have enough capacity to withstand severe losses. Indeed, the resources pooled in the default waterfall make it possible to shift the risk from banks to CCPs (Singh 2011). Moreover, this capacity is strengthened by various incentives. CCPs can be regarded similarly to all the other entities that strive for profit and notwithstanding prudent risk management they may still be interested in minimising costs and losses. Such a perspective enables us to assume that in order to avoid loss mutualisation CCPs would be encouraged to manage risk in a prudent manner, and in particular to use their own resources to this end, just as is the case with the DW. Given the fact that it is impossible to predict any severe turbulences, loss absorption capacity of the DW remains crucial.

So far the importance of the default waterfall has been acknowledged by many authors. Cont (2015), Nixon and Rehlon (2013), Cont (2017) focus on the general features of the default waterfall, whereas BIS (2014), Carter and Garner (2015), Bellia et al. (2017), Murphy (2017), Singh and Turing (2018) emphasise the role of certain incentives affecting the funds earmarked for each of DW layers. What, however, is crucial in the matter of the DW, is that resources gathered in the default waterfall have loss absorption capacity which if not pooled, would be inaccessible for any single institution. Therefore, CCPs can be regarded as a unique firewall in international financial markets. The default waterfall's main function

is to protect CMs from credit counterparty risk that is traditionally embedded in transactions such as OTC derivatives (Koeppl, Monnet 2013). So in the case of the default of a CM, the losses are retained by the CCP. Heath et al. (2016), Cox and Steigerwald (2017) stress that apart from the default waterfall another aspect that distinguishes CCPs from any financial institution is a different risk profile of a CCP from that of a bank. A CCP should maintain a 'matched book' at all times, which means that any position should be offset by another position. Hence, a 'matched book' carries no market risk and the financial risk borne by the CCP has its only source in cleared positions (Nixon, Rehlon 2013; Cox, Steigerwald 2017).

Furthermore, it is also worth noticing that CCPs are subject to much stricter requirements than banks and other financial institutions, which consist, among others, in limitations that are imposed on CCPs' investment policy.

Due to its functions and the design of the central clearing mechanism, CCPs are exposed to certain risks that are linked together, and which undealt with may pose significant threats to financial stability. These are mainly concentration, systemic, legal, credit, general business, custody and investment, liquidity and operational risks. The overview of these risks is provided in CPSS-IOSCO (2012) Principles for Financial Market Infrastructures (PFMIs), which provides 24 principles governing the afore--mentioned risks, among others.

Yet, according to PFMIs such risks require different measures helping to monitor the viability of CCPs. Hence, PFMIs recommend various tools ranging from monitoring the current and potential future exposure to rigorous stress testing, reverse stress testing and back testing.[5]

Also the European Union developed its own provisions regulating stress testing, reverse stress testing and back-testing of CCPs, which are outlined in Chapter XII in Commission Delegated Regulation No. 153/2013[6] and which mainly specify key elements and parameters that should be included in stress tests. In this regard it is worth mentioning that in 2015 and 2017 ESMA performed two EU-wide CCP stress tests. Each of them put emphasis on different aspects of central clearing. The first one focused mainly on credit counterparty risk (ESMA 2016b), whereas the latter extended its scope and included a wide description of liquidity risk[7] (ESMA 2018). Both stress tests assumed extreme and unlikely scenarios and tested CCPs' prefunded resources.[8]

As emphasised by several authors, including Gregory (2014), France and Kahn (2016), Heath et al. (2016), Cont (2017), ESMA (2018), mandatory central clearing is strictly connected with liquidity. It can be viewed in two perspectives: the market's perspective and the participants' perspective. Since mandatory central clearing requires posting collateral and paying clearing fees, it imposes an additional burden on CMs. What is more, as mentioned in previous sections, the instruments provided as collateral must be of the highest liquidity and premium credit quality. As a result, in the long term participants may be deterred from concluding centrally-clearable transactions in order to

[5] PFMIs indicate that when constructing stress tests and reverse stress tests, CCPs should take into consideration scenarios including relevant peak historic price volatilities and shifts in market factors (prices, yield curves, multiple defaults over various time horizons, simultaneous pressures in funding asset markets).

[6] Commission Delegated Regulation (EU) 153/2013 of 19 December 2012 supplementing Regulation (EU) No. 648/2012 of the European Parliament and of the Council with regard to regulatory technical standards on requirements for central counterparties, O. J. L 52/41.

[7] In the liquidity stress testing the defaults of the most relevant entities such as CMs, issuers, custodians, payment banks and repo counterparties were taken into consideration.

[8] As this paper does not strictly concern CCP stress-testing, the issue was described here briefly. For further details (assumptions, stress scenarios, reverse stress testing, etc.) please consult ESMA (2016b) and ESMA (2018).

avoid additional opportunity costs which result from central clearing. As a consequence, the liquidity of the derivatives markets may drop, which means that liquidity in the underlying assets market would also be negatively affected (France, Kahn 2016). In addition, CMs not only freeze their assets for a long time but are also obligated *ex post* to support the CCP with additional promissory resources should the initial layers of the default waterfall run out. Such a construction of the central clearing mechanism makes CCPs exposed to the liquidity risk which may materialise if a CCP is unable to provide liquidity (usually if financial resources gathered in the default waterfall are depleted). In this connection, Cont (2017) concludes that central clearing transforms credit risk into liquidity risk. Pirrong (2011) goes even further concluding that liquidity risk may be a channel for amplifying systemic risk.

A CCP may also suffer from the typical risks that affect corporations, such as legal risk and operational risk. The latter has been recently addressed by the European regulators in the proposal of the so-called CCP Recovery and Resolution (CCP-RR) which makes the distinction between default and non-default events.[9] Also the legal risk gains in importance as central clearing environment becomes more and more regulated. In addition to all the above, Gregory (2014) notices that CCPs may face other risks which are often omitted in the literature, but should not be underestimated, and which include the settlement and payment risk, FX risk, custody risk, sovereign risk and wrong-way risk.

Taking into consideration all the described features of the central clearing mechanism it is barely possible at this general level to assess whether mandatory central clearing contributes positively to financial stability. Therefore, it is crucial to provide certain measures which would help monitor the condition of central counterparties and thereby help answer the question if CCPs are able to withstand market turbulences and whether they comprise a viable macroprudential tool for systemic risk mitigation.

This paper formulates the following research questions: What is the optimum level of DW layers? Does the current DW structure ensure proper incentives for central clearing participants? Does the current DW structure contribute positively to the loss absorption capacity of EU CCPs?

Addressing the above questions this paper constitutes an attempt to formulate certain indicators aiming at delineating the empirical structure of DWs across the EU-authorised CCPs for Q4 2015–Q4 2017. In particular, it provides a qualitative and quantitative assessment of the capacity of default waterfalls which are at the disposal of the EU-authorised CCPs to withstand losses arising in extreme but plausible market conditions. Extreme but plausible market conditions have not been directly defined in the law of the EU, however, under article 29 of Commission Delegated Regulation No. 153/2013 such conditions are identified by CCPs themselves and are described as those exposing CCPs to the greatest risks. Such an assessment and proposed indicators constitute a supplement to stress testing. The analysis was based on CPMI-IOSCO (2015) Public quantitative disclosure standards for central counterparties (PQD) and the PQD data provided by 15 EU-authorised CCPs. The analysis of empirical data is supplemented by the examination of incentives driving particular clearing participants that significantly determine the structure of DWs and thereby may contribute to the overall condition of the central clearing system. Moreover, the analysis aims at providing an insight into the question

[9] The distinction is crucial as in the proposal it is foreseen that CCPs would have to keep additional resources for non-default events. Such a proposal confirms the increasing role of operational risk. For further details, see: Proposal for a Regulation of the European Parliament and of the Council on a framework for recovery and resolution of central counterparties and amending Regulations (EU) No. 1095/2010, (EU) No. 648/2012, and (EU) 2015/2365, 28 November 2016, COM (2016) 856 final, 2016/0365(COD).

which entities and layers of the DW are the most influenced by the incentives. Depending on this assessment conclusions can be drawn on CCPs' ability to act as a backstop to widespread contagion in financial markets.

So far the structure of DWs and loss absorption capacity of CCPs have been addressed in the first place by Nahai-Williamson et al. (2013), Murphy and Nahai-Williamson (2014), France and Kahn (2016), Heath et al. (2016), Armakolla and Bianchi (2017) Cerezetti et al. (2017), Murphy (2017), Alfranseder et al. (2018). Only in Armakolla and Bianchi (2017) and Alfranseder et al. (2018) PQD data have been used for the assessment of CCPs. This paper, however, provides a different approach than the one presented in the above-mentioned papers, mainly by taking advantage of PQD data to describe the empirical structure of DWs along with the use of non-prefunded resources as well as by proposing the use of different parameters in the construction of indicators.

The paper consists of five sections. The second section briefly touches upon the general concept of central clearing. The third section provides a theoretical insight into the default waterfall mechanism, which provides a starting point for further analysis. The fourth section constitutes the core part of the paper, presenting the empirical structure of default resources and examining their loss absorption capacity, based on the PQD data. The last section reflects on the results of calculations and provides an extended discussion of the examined issues.

2 General concept of mandatory central clearing in the EU

Before the 2007–2009 crisis there was no legal framework that regulated the OTC derivatives market and central clearing issues. The only attempt to govern this market segment was limited to the set of rules introduced in 2004 by the Committee on Payment and Settlement Systems and International Organisation of Securities Commissions that created a basis for good practices which, however, were not mandatory. In 2012 the above-mentioned organisations issued an updated and extended version of Recommendations known as PFMIs which created a basis for the PQD. To a large extent, the Principles were incorporated in the EU law by EMIR which introduced the mandatory central clearing of OTC derivatives. EMIR is supplemented by several Commission Delegated Regulations and other legal acts directly regulating particular issues concerning OTC derivatives.

Under EMIR a CCP is a legal person whose main aim is to reduce credit counterparty risk and systemic risk. According to Kroszner (2006) CCPs were known earlier, even before mandatory central clearing was introduced. Therefore, the concept of such a person is not new. However, the novelty of the CCP as a macroprudential tool consists in the shift from private to public market, so as to regulate exactly this market segment which remained traditionally unregulated, as well as in the shift from the micro to the macro level.

To become eligible for central clearing, CCPs must meet strict requirements. First of all, under Article 14 of EMIR a CCP must be authorised by a national competent authority. The authorisation is granted only for activities related to central clearing and covers activities involving certain asset classes. In order to get the authorisation, a CCP must also ensure proper risk management and maintain certain organisational requirements, such as governance arrangements, risk management and internal control mechanisms, compliance procedures, separation of the reporting lines, etc.

Under Article 16 of EMIR in order to get the authorisation a CCP is also obliged to provide initial capital that amounts to at least EUR 7.5 million and is permanent and available. Commission Delegated Regulation No. 152/2013[10] further specifies that a CCP is obliged to keep financial resources at least equalling the sum of CCP's capital requirements for winding down or restructuring its activities and capital requirements for, among others, operational, legal, credit, counterparty, market and business risks.

The day-to-day supervision of CCPs is performed by national competent authorities. In this matter, the EMIR regime also refers to the CCP college, whose role is to facilitate tasks such as the extension of initial authorisation and the procedure of granting and refusing authorisation including the approval of interoperability arrangements. It also evaluates CCPs' models and parameters used for margins, DF contributions, collateral requirements and other risk control mechanisms calculations.[11]

Since the CCP should grant financial stability, it is allowed to perform only secure and restricted activities. Its investment policy must be prudent and limited to the safest instruments. According to Article 47 of EMIR, a CCP can invest its resources only in cash or highly liquid financial instruments that have minimum market and credit risk.

As of 2019 the central clearing obligation concerns all standardised classes of OTC derivative contracts that are outlined in Commission Delegated Regulations No. 2015/2205, 2016/592 and 2016/1178. The list will probably be extended, however, it may still be limited due to the fact that not all OTC derivatives are suitable for central clearing. The clearing obligation is primarily restricted to certain OTC derivatives classes which should meet the criteria developed by ESMA and whose valuation should be possible – a requirement which, as indicated by Heller and Vause (2012), in the case of poor liquidity in such markets may pose difficulties.

When it comes to assessing the eligibility of OTC derivatives for central clearing, two approaches are distinguished: bottom-up and top-down. The first one is market driven whereas the latter is ESMA driven. The bottom-up approach is related to the CCP authorisation process and connects a clearing obligation with the CCP's practice. The top-down approach consists in emulating the bottom--up approach and means that OTC derivatives contracts should at first be assessed as systemically relevant and recognised by regulators as eligible for central clearing. Moloney (2014) finds that the first approach makes the clearing obligation wider whereas the second one makes it more peripheral. In the EU, the top-down approach is applied. Therefore, each authorisation of a CCP is valid for particular OTC derivatives classes, which means that to centrally clear each OTC derivative transaction the CCP needs an authorisation for each class; it is granted by a national competent authority after the CCP meets the conditions.

The EMIR regime also presumes that counterparties report detailed information about each concluded transaction to the authorised trade repository. The whole list of required information

[10] Commission Delegated Regulation (EU) 152/2013 of 19 December 2012 supplementing Regulation (EU) No. 648/2012 of the European Parliament and of the Council with regard to regulatory technical standards on capital requirements for central counterparties, O. J. L 52/37.

[11] One should bear in mind that such a model is about to be changed by the currently legislated EMIR 2.2. For further details, please consult: Proposal for a Regulation of the European Parliament and of the Council amending Regulation (EU) No. 1095/2010 establishing a European Supervisory Authority (European Securities and Markets Authority) and amending Regulation (EU) No. 648/2012 as regards the procedures and authorities involved for the authorisation of CCPs and requirements for the recognition of third-country CCPs, June 2017, COM (2017) 331 final, 2017/0136 (COD).

consists of 94 items and is provided in Commission Delegated Regulation No. 2017/104.[12] Such an obligation contributes positively to the increase in market transparency and helps to avoid information asymmetry.

2.1 Central clearing participants

The central clearing mechanism assumes that a central counterparty interposes itself between two original sides of the contract and becomes the buyer to the seller and the seller to the buyer. Therefore, one contract is replaced by two new ones. Technically speaking this process is called novation. The mechanism also presumes another type of process known as open offer in which after all the terms and conditions have been met the central counterparty automatically interposes itself between both sides of the contract.

Under Article 4 of EMIR three models of participation in CCP clearing are foreseen, so entities may become either a clearing member (CM) or a client of a clearing member (C, but also known as non--clearing member, NCM) or participate in the so-called indirect clearing arrangement.

A clearing member is a participant that is directly involved in central clearing. Since this form of membership requires clearing fees and certain prerequisites established by a particular CCP, it is rather popular among relatively big financial institutions, especially banks. By setting requirements for its CMs, a CCP ensures resilience and viability of the whole centrally cleared market.[13] The CM also becomes an intermediary that enables clients to participate in central clearing even though they are unable to meet the conditions of CCPs to become a CM and/or to pay clearing fees. The last model, indirect clearing arrangement, presumes that each client can provide their clients with indirect clearing services. However, this client is also required to meet additional conditions. In Title V EMIR also allows for so-called interoperability arrangements in which CCPs directly become clearing members of other CCPs. However, in Recital 73 EMIR limits the use of interoperability arrangements to transferable securities and money-market instruments. ESMA, in turn, indicates that interoperability arrangements for ETD and OTC derivatives are not prohibited despite EMIR not covering such links (ESMA 2013).[14] Currently, there are five interoperability links between the EU CCPs and recognised third-country CCPs, which were established before the EMIR regime came into force (ESRB 2016).

In Article 4 EMIR introduces also two categories of participants that are based on the type of their core activity. It distinguishes the financial counterparty (FC) and the non-financial counterparty (NFC). Financial counterparties are defined as investment firms, credit institutions and insurance, assurance and reinsurance undertakings and, as a rule, the firms that manage clients' assets, whereas non-financial counterparties are any other entities whose core business does not consist in financial activities. Pursuant to Article 2 of EMIR mandatory central clearing is applicable to contracts that are concluded between two financial counterparties, a financial counterparty and non-financial

[12] Commission Delegated Regulation (EU) 2017/104, of 19 October 2016 amending Delegated Regulation (EU) No. 148/2013 supplementing Regulation (EU) No. 648/2012 of the European Parliament and of the Council on OTC derivatives, central counterparties and trade repositories with regard to regulatory technical standards on the minimum details of the data to be reported to trade repositories, O. J. L 17/1.

[13] Some CCPs present requirements for clearing members as a part of their risk management framework after which layers of the default waterfall follow.

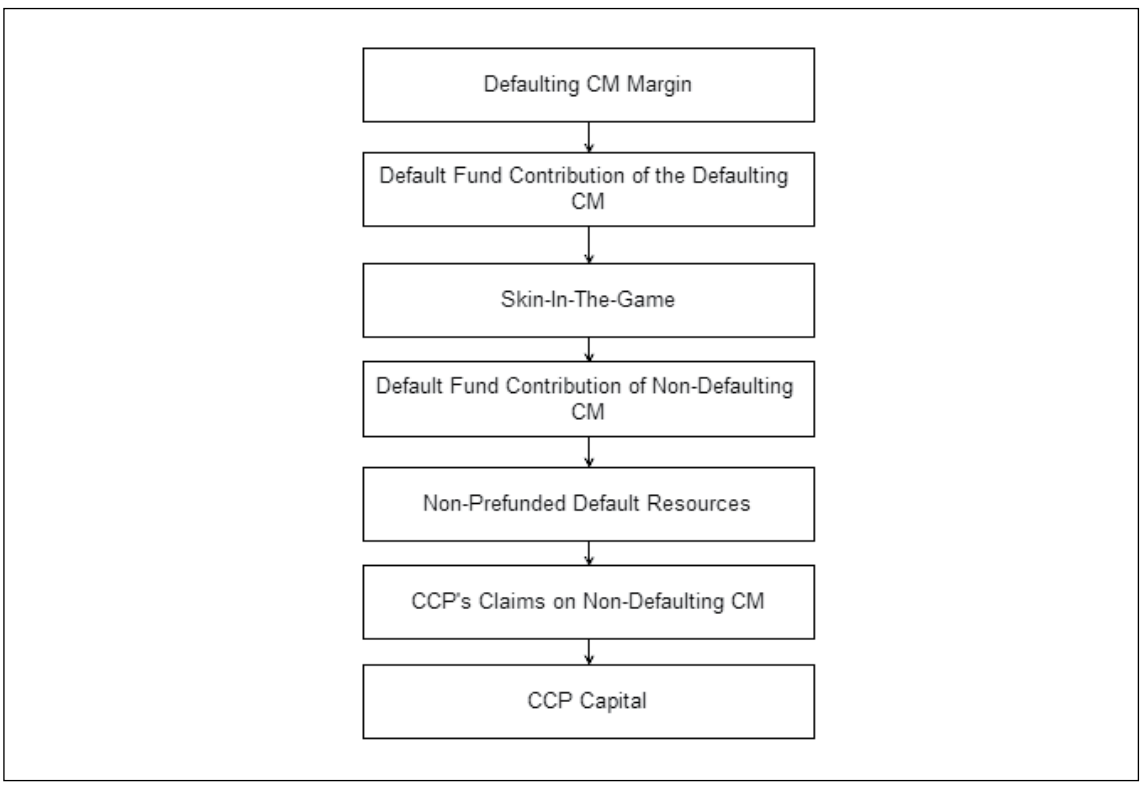
[14] However, due to the increased interconnectedness stemming from such links, such an idea remains controversial and ambiguous.

counterparty and between two non-financial counterparties. However, since the activity of non--financial counterparties differs from the activity of their financial equivalents, to be subject to central clearing first they have to meet conditions outlined in delegated acts.

2.2 Default waterfall mechanism

As the main aim of a CCP is to help mitigate systemic risk, proper risk management should be of the highest priority. Therefore, regulators equipped CCPs with a unique tool – a default waterfall. The primary purpose of the default waterfall is to ensure financial stability by providing financial resources that would be sufficient to withstand multiple defaults of the clearing members. Under EMIR the DW consists of several layers. Each of them has specific functions and plays specific roles which are described in the next section. The exact sequence of the default waterfall is crucial since each layer creates various incentives for prudent risk management for both CCPs and CMs. Figure 1 presents the basic structure derived from EMIR.

Figure 1
Default waterfall structure



Source: own study.

Generally, as indicated by Moloney (2014), a CCP contributes to financial stability in two ways: *ex ante* by assessing credit counterparty risk and by collateralisation, and *ex post* by conducting close--out sales and by using the default waterfall mechanism should any counterparty default. Because of this, it is highly recommended that the default waterfall keeps this sequence. The DW varies within CCPs but generally the structure remains the same.[15]

In the case of a default of any clearing member, a CCP is obliged to maintain continuity of the contracts and keep a 'matched book'. The default can be defined as the inability of a counterparty to meet its obligations. Therefore, the catalogue of the examples of default is wide and may vary from inability to make margin payment to even a failure of an entity. In that case, the CCP decides whether to deem the CM as defaulted. After that the CCP has several ways to deal with it, however, the most important thing is, as mentioned before, to maintain a 'matched book'. The CCP can do it by closing out outstanding contracts of the defaulted CM or partially tearing them up. However, those solutions are not popular since the CCP has to pay non-defaulting CMs a compensation for closed or partially torn up contracts (Gregory 2014). It can also guarantee them by replacing defaulting counterparties by other ones. This is done in auctions that are more popular among CCPs (Gregory 2014). What is, however, the most important here, is to perform auctions as soon as possible since any delay may expose CCPs to various risks and result in further losses (Cerezetti et al. 2017).[16] In addition, Gregory (2014) emphasises that non-defaulting members have strong incentives to participate in auctions and to replace the defaulting counterparty since a failure of an auction means triggering the default waterfall mechanism.

3 Theoretical structure of default waterfall

3.1 Margins

Under EMIR margin creates the first layer of the default waterfall and is also known as the first line of defence. There are two types of margin: the variation margin (VM) and the initial margin (IM). The distinction is crucial as both types, especially their functions, vary significantly. When considering margin as a layer of the default waterfall, only the initial margin is taken into account.[17]

The variation margin (mark-to-market margin) is used before declaring a default of a CM, after which mainly the IM follows, and its main purpose is to protect counterparties from market risk. As the CCP has to provide a 'matched book' all the time and as contracts are not immune to market changes, to maintain a 'matched book' it is crucial for CMs and CCPs to provide variation margins so as to ensure marking to market (Cont 2015). Therefore, the variation margin is used to cover losses stemming from market prices movements and hence, to provide protection should mark-to-market losses occur. It has to be paid by either the counterparty or the CCP if the market price of a given derivative contract tumbles. As a fall in prices forces prompt actions, the variation margin is typically paid in cash. In addition, the variation margin is not a new concept and had been well known even before mandatory central clearing was introduced. It is also a traditionally used method of minimising market risk on bilateral markets (Kroszner 2006; BCBS-IOSCO 2015).

[15] For example, many CCPs have more than one default fund, each for a particular asset class.

[16] Losses may stem from the fact that the default may be a trigger for the fire sale of assets and hence, a vast surge in their value. Therefore, appropriate timing is crucial here.

[17] Therefore, in this paper when describing the default waterfall, the concept of margin means the initial margin.

The initial margin, in turn, differs from the variation margin as its main aim is to provide protection against credit counterparty risk and to enable counterparties to withstand the worst-case close-out costs that stem from a need to replace transactions (Gregory 2014). Traditionally, the initial margin was rarely used as it is cost-intensive and imposes an excessive burden on trading parties (BCBS-IOSCO 2015). Not only is cash accepted as initial margin, but also other highly liquid and high credit quality instruments are allowed. The level of the required initial margin may vary within the lifespan of the contract as it should reflect market conditions and the remaining risk. Under Article 41 of EMIR margin should be sufficient to enable the CCP to cover losses stemming from nearly 99% of price movements in a given period of time as well as to cover potential exposures that may occur until liquidation of the positions of the defaulting CM.

The level of the required IM is determined by various models, such as value-at-risk (VaR), expected shortfall or standard portfolio analysis (SPAN) that are developed by CCPs and which have to be accepted by national competent authorities (Priem 2018).[18] Generally, the level of the initial margin depends strictly on the margin model and its parameters, as well as the characteristics of the concluded contract. In other words, the riskier the derivative contract, the higher the margin. Houllier and Murphy (2017) give an extended description of margin models. They notice that despite the same parameters two different margin models may lead to substantially different IM levels. Since the initial margin imposes a relatively high burden on CMs, theoretically the lower the margin, the better. A lower margin collateral means that CMs do not need excessive liquidity to meet the conditions imposed by CCPs and do not need to freeze particular very liquid assets of high credit quality. Margins can also be treated as an insurance policy. CMs pay the CCP for protection against the default of a counterparty. As each participant assumes that the CCP enforces prudent risk management, the risk of default remains relatively low. Therefore, given some level of their activity, in theory CMs should strive for the lowest initial margin possible. This desire is strengthened by the fact that initial margins are used first. However, EMIR forbids to use the initial margin of a non-defaulting CM to cover losses in order to enforce prudent risk management from both the CCP and the CM that is about to fail. On the other hand, the construction of the default waterfall encourages the CCP to demand a reasonable level of the initial margin since the third layer of the mechanism constitutes a so-called SITG that is nothing but a CCP's contribution to these pooled resources. Nevertheless, imposing high initial margins is not in the interest of the CCP as demanding such a level of margin collateral means that the CCP can lose its CMs, which as a result may choose other CCPs whose requirements are lower (Singh 2010). Therefore, the optimum level of margin is barely possible to assess. Nevertheless, it is recommended to gather enough resources to meet the conditions that are outlined in Article 41 of EMIR. In practice, CCPs cumulate more resources than needed (overmargining), which is described at length in the next section.

As the margin creates the first layer of the default waterfall, it is assumed that it is also as liquid as possible. Under Article 46 of EMIR it has to be also of the highest credit quality. CCPs can acquire highly liquid financial instruments issued by governments, central banks, etc. Moreover, gold and bank guarantees are accepted, however, the latter only in the case of NFCs.

[18] For example, Poland-based KDPW_CCP uses the HVaR model to calculate the level of the initial margin. For further details, see: http://www.kdpwccp.pl/en/Risk-Management/otc/Pages/HVaR-collateral.aspx. Another CCP, i.e. LCH Clearnet SA, on the contrary, uses different margin models for different clearing services (CDS, repo, tri-party repo, etc.) which are VaR, expected shortfall (ES) and SPAN. For further details, please consult: https://www.lch.com/index.php/risk-collateral-management/group-risk-management/risk-management-sa.

EMIR also imposes on CCPs an obligation of applying haircuts to the collected instruments as their value may deteriorate over time. According to Article 46 EMIR also enables CCPs to accept baseline instruments as margin collateral, however, only when appropriate.

Under Article 47 of EMIR the gathered margin is deposited on the accounts of the operators of securities settlement systems. As an alternative, CCPs are allowed to conclude highly secure arrangements with authorised financial institutions. If it is not possible to deposit the margin with the above-mentioned operators, Commission Delegated Regulation No. 153/2013 enables the CCP to deposit margins with the following institutions:

a) a central bank,

b) an authorised credit institution,

c) a third country financial institution.

In practice, the collateral is held on central bank accounts and invested in low-risk and safe government bonds. Each CCP has its investment policy where further details are provided.[19] In addition, some CCPs may pay their CMs interest on cash that is posted as initial margin in order to compensate the need for providing high-quality liquidity (Gregory 2014). It is worth noticing that as emphasised by NBP (2013), Cont (2015), Lin and Surti (2015), imposing high level of margins may lead to increased procyclicality. It means that in the case of any severe market turbulences CMs will be forced to provide more resources, which can significantly contribute to the fire sale of other assets and hence, to a further drop in their prices. In order to minimise procyclicality CCPs are allowed to use additional measures that are more or less equivalent to imposing an additional margin buffer or assigning additional weights to stressed observations.

3.2 Default fund contributions

Should losses exceed the amount of the initial margin provided by the defaulting CM, pursuant to Article 45 of EMIR the CCP is obliged to use resources in the form of contributions of the defaulting CM to the default fund. This layer of the default waterfall is provided *ex ante* by CMs who contribute to the default fund in a proportionate manner.

As stated in Article 42 of EMIR, the main aim of a default fund is to provide an additional protection that should be sufficient to enable a CCP to withstand losses that occur in extreme but plausible market conditions and that stem from the default of the CMs to which the CCP has the largest exposure or of the second and third largest CMs should the latter aggregate exposure be larger.

Generally, contribution to the default fund is a novelty. Apart from providing an additional protection for clearing members, its main purpose is to eliminate the free-riding problem and to ensure that each counterparty bears costs. It depends mainly on CMs whether it will be necessary to deplete the funds.

Under Article 42 of EMIR a CCP specifies the minimum default fund level below which it must not fall. The regulation also enables the CCP to create more default funds for each type of cleared assets.

According to Article 47 of EMIR a CCP is allowed to invest contributions to the default fund in the same classes of instruments as in the case of initial margins.

[19] By way of example see the investment policy provided by KDPW_CCP: http://www.kdpwccp.pl/en/Risk-Management/Documents/KDPW_CCP_Investment_Policy_EN.pdf.

Similarly to the previous layer, it is difficult to determine an appropriate level of the default fund. First of all, since CMs provide initial margins, which impose a huge cost, they are barely motivated to provide additional resources which may protect them from a potential default of other clearing members. It should be borne in mind that after the depletion of the contribution of the defaulting CM to the DF, the CCP uses its contribution (SITG). Also, contributing to the default fund means that the CCP may as well use contributions of non-defaulting CMs should the SITG be insufficient. Hence, one may assume that CMs have low economic incentives to participate in the default fund and to provide sufficient resources. As the CCP incurs no costs in the first stages of the DW and on the contrary, CMs do, CMs strive for the lowest DF contributions as possible. On the other hand, the CCP is mostly interested in the highest contributions. As in case of margins, the optimum level of default fund contribution is hard to determine, however, it strictly depends on the exposures of the CMs.

Default fund contributions provided by non-defaulting CMs create strong incentives for conservative risk management and active participation in the default management process. A CCP may encourage CMs to actively participate in auctions and in the case of default use contributions of non-defaulting CMs that bid the least competitively (Carter, Garner 2015). However, as mentioned by Gregory (2014) it is thought that including these contributions into the default waterfall may somehow cause moral hazard as it leads to the belief that survivors will pay anyway. So again, the likely-to-default counterparty may be incentivised inasmuch as it has to provide resources to the default waterfall.

3.3 Skin-in-the-game and other CCP's contributions

The next layer of the default waterfall consists of the SITG. It is presumed to be used if losses exceed both the initial margin and the default fund contribution provided by the defaulting CMs. This layer should be pre-funded and dedicated by the CCP. It should be noted that resources committed by the CCP in that layer are not identical with the initial capital needed by the CCP to get an authorisation, which must not be used as the CCP's contribution to the pooled resources. What is more, EMIR presumes that the default fund and the SITG, so actually three out of seven layers, should enable the CCP to withstand the default of two CMs to which the CCP has the largest exposures.

The minimum level of the SITG is outlined in Commission Delegated Regulation No. 153/2013 and amounts to at least 25% of the minimum capital that is required from a CCP, including its earnings and retained reserves. To obtain the amount committed in this layer the initial capital is not to be taken into account in calculations. In addition, that amount must be revised every year and kept separately on the balance sheet.

Due to its position in the default waterfall, the SITG has to create incentives for CCPs for prudent risk management. After the default of a CM, at first resources provided by the defaulting CM are used. Actually, the CCP may be interested in promoting proper risk management among CMs only insofar as the losses do not exceed the first two layers of the default waterfall. If the losses do surpass the second layer, the CCP is forced to use its own resources, which is painful. Therefore, to encourage sound risk management, the SITG should be reasonably commensurate with other layers. In general, CCPs should strive for the lowest SITG, the highest margins and DF contributions to ensure that the likelihood of using this layer remains low. However, by doing so the CCP may affect negatively CMs' willingness to trade as the level of trading activity is strictly connected with the level of margin and hence, the level

of costs borne by CMs. As pointed out by Singh and Turing (2018) a low SITG may also help force CMs into competitive bidding during auctions. On the other hand, if the SITG is relatively high, CMs may be discouraged from proper risk management as they would be sure that in the case of default, at first resources provided by the defaulting CM and then by the CCP are used. Therefore, the optimum level of the SITG is needed in order to maximise the willingness of the CMs and the CCP to manage risk appropriately.

Not only the SITG but also CCP capital constitute the CCP's contribution to the default waterfall, which forms the last available layer. It is indirectly mentioned in Article 16 of EMIR, according to which this layer should be sufficient to provide the CCP with protection from credit counterparty, operational, business and other risks in case all previous layers are exhausted. In addition, this layer is not identical with the CCP's initial capital. Under Article 4 of the Commission Delegated Regulation No. 152/2013 the CCP should determine the level of the required capital by calculating risk-weighted exposures for credit and counterparty risk. As indicated by Priem (2018), if all resources gathered in the default waterfall are depleted, the CCP should introduce recovery measures. However, at this stage a uniform recovery and resolution framework for CCPs in the EU is still under negotiations.

3.4 Non-prefunded resources

Pursuant to Article 43 of EMIR a CCP may collect extra non-prefunded resources from non-defaulting CMs, which is, however, non-mandatory. The resources are also known as 'assessments'. They vary significantly from previous layers since pre-funded resources are provided *ex ante* and assessments only *ex post,* hence their promissory character (Carter, Garner 2015). These additional resources constitute the fifth and the sixth layer of the default waterfall. The CCP is highly motivated to impose such an obligation on its CMs due to the fact that if losses exceed pre-funded resources, it is mostly the CCP that may suffer. However, non-prefunded resources pose a significant threat as relying on them means relying on a liquidity that is provided by non-defaulting CMs. What is more, as emphasised by France and Kahn (2016) due to the severe market conditions in which those layers are presumed to be used, CMs may be unable to provide such a liquidity promptly. Hence, non-prefunded layers transform credit counterparty risk into liquidity risk, which casts shadow on the soundness and efficiency of central clearing (Cont 2017).

This additional contribution may be based on the size of the remaining CMs, for example, on the proportion of open positions or on volume (France, Kahn 2016). Including non-prefunded resources in the DW may create a trigger for proper risk management among non-defaulting CMs and for active participation in default management procedures performed by the CCP. However, a low likelihood of the depletion of such funds weakens the incentives (Carter, Garner 2015).

Nevertheless, as indicated by Duffie (2014), 'assessments' should be a part of the default waterfall but these additional calls should preferably be limited and contractually capped.

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