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## **A CCP is a CCP is a CCP\***

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# *A CCP is a CCP is a CCP*

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## **Abstract**

Central counterparties (CCPs) are an important part of contemporary financial market infrastructure. The orderly risk management operations and financial resilience of CCPs and other market infrastructures are essential for financial stability.

Regulators and other policymakers face a major challenge constructing appropriate regulatory frameworks for central clearing, given unique features of CCP risk profiles and, in particular, the mutualization of default losses. While CCPs may have superficial similarities to other infrastructures and exposed to risks like those borne by banks and other participants in the financial system, CCPs are best seen as “commitment mechanisms” that assure the performance of financial contract obligations. How they perform that function sets them apart from other infrastructures, intermediaries and financial institutions.

The challenge of establishing standards for CCP risk management and resilience is even more difficult when policymakers view CCPs through the lens of bank regulation. CCPs are not banks. Their function as commitment mechanisms bears little resemblance to the risk-taking function of banks. Nor are CCPs depositories, payment systems, insurance companies or exchanges, although they have features that resemble insurance and may have connections to other market infrastructures

This paper discusses many differences between CCPs and banks and the significance of those differences, including their business models and risk profiles, with CCPs acting as risk managers that are uniquely subject to the credit and liquidity risk of clearing member default. In particular, we focus on differences in the roles that capital and collateral play in connection with CCP and bank risk management. From this discussion, we draw the following policy conclusions: (1) a CCP’s capital cannot be the primary (or a significant) resource for loss absorption without fundamentally altering the incentive structure embedded in the default “waterfall” through which losses are mutualized, if not the business model of the CCP itself; (2) accordingly, capital analysis alone tells us little or nothing about CCP resilience or ability to recover from threats to the viability of the CCP; and (3) stress testing for CCPs must focus on features that are unique to central clearing, principally the possibility and consequences of member default.

## Introduction

Banks, it is often said, are “special.” Corrigan (1983).<sup>1</sup> Central counterparty clearinghouses (CCPs) also are “special” in that they can be systemically important Bernanke (2011), p. 1.– but banks and CCPs are special in very different ways.

CCPs are not banks. Cœuré (2015). They do not perform the central risk-taking function that distinguishes banking: asset/liability (or maturity) transformation through deposit taking and lending and related activities.<sup>2</sup> The balance sheet of a CCP is “quite different from those of other major types of systemically important financial institutions such as banks, broker-dealers, and insurance companies.” Duffie (2015); Hughes & Manning (2015); Hughes & Manning (2016). Moreover, CCPs are not exchanges, depositories, or payment systems, although they have features that resemble insurance and may have connections to other market infrastructures.<sup>3</sup>

What are CCPs? In this paper we claim that a CCP, viewed from an economic perspective, is a “commitment mechanism.” The ultimate function of a CCP is to assure performance of contract obligations. They do so by becoming substituted counterparties to all trades submitted for clearing – becoming, in effect, “the *buyer to every seller and the seller to every buyer* . . . thereby ensuring the performance of open contracts. BIS (2012), p. 9.<sup>4</sup>

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<sup>1</sup>See also, Gorton (2014), pp. 826-27; McKinley (2015); Saunders (2015).

<sup>2</sup>We recognize that some CCPs are licensed as “credit institutions” (a legal requirement in some European countries) and that two U.S. CCPs were chartered as limited purpose trust companies. See, e.g., Board of Governors (1996)(Multinet International Bank order); Board of Governors (2009)(ICE US Trust LLC order). Therefore, CCPs may technically qualify as “banks” of one sort or another. That, however, is of no consequence for purposes of the discussion in this article. As explained above, CCPs – regardless of their form of charter or license – do not perform banking functions. Accordingly, as Cœuré (2015) explains:

[W]e should not try to apply blindly to CCPs the macroprudential tools we have developed for the banking sector. Unlike banks, whose social function is to transform risk and maturity, CCPs are not in the business of taking risk directly but of pooling risk. Therefore, we do not want to regulate them primarily as risk takers. Instead, our aim is to control the way they propagate risk, including in particular the way they allocate losses in case of a participant’s default. Cœuré (2015)

<sup>3</sup>Central counterparty clearing initially developed in connection with exchange-traded commodity markets, Norman (2011); Steigerwald (2015), and some CCPs are related to other market infrastructures.

<sup>4</sup>By contrast, Ghamami (2015), pp. 3-4, views a CCP as “a financial institution that holds a portfolio of clearing members’ portfolios” and asserts that a CCP is “exposed to its portfolio counterparty credit risk, where the portfolio constituents are the CCP’s clearing members’ derivatives portfolios, and the CCP’s exposure to each clearing member is collateralized by both variation and initial margin.” Ghamami (2015), p. 9. This description mischaracterizes “variation margin,” the exchange of mark-to-market settlement payments for cleared contracts, as collateral. Except in specific circumstances (e.g., the margining of options positions), variation settlements are passed through by the CCP from clearing members with out-of-the-money positions to those with in-the-money positions. More importantly, this treatment of central clearing betrays a failure to clearly recognize that the bilateral relationship between the members that submit trades for clearing is irrevocably terminated by novation (or an equivalent legal

To understand our claim that CCPs are commitment mechanisms, we need to understand that participants in financial markets cannot credibly commit to meet their financial obligations without relying on clearing (or a similar institution). As Nosal & Steigerwald (2010) explain, this is important because, “in the absence of clearing, contractual performance of many financial products would be severely impaired and . . . society would have to resort to less efficient means of exchange.”<sup>5</sup>

Understanding that CCPs are institutions structured to assure commitment is critical to recognizing that, unlike banks, they are not in the business of risk-taking. CME Group, et al. (2015), p. 3. To be sure, risk is transformed, rather than eliminated, through central clearing and a CCP – as the substituted counterparty to all trades accepted for clearing – plays an important role in managing the associated credit, liquidity, operational and other risks, as well as providing a mechanism for market entry and exit that supports liquidity. However, the primary function of a CCP is to assure that clearing members meet their obligations in accordance with the CCP’s rules.<sup>6</sup> This function is fundamentally different from the risk-taking functions performed by depository or credit institutions.

CCPs developed from the evolution of clearinghouses, with counterparty substitution introduced in the late 19<sup>th</sup> Century. This was in response to the resolve of commercial interests to find a means of risk management for specific commodity trading risk. Norman (2011); Steigerwald (2015). Clearinghouses essentially developed as “clubs” – in which members jointly contributed to the management of risk, ultimately culminating in the modern formula of clearing member “loss mutualization.” Cox & Steigerwald (2016).

Although this evolution was based, in part, on models drawn from payment clearing arrangements, Moser (1998); Steigerwald (2015), it was a distinct development that took place outside of ordinary banking practice and was not initially supported by explicit law or public policy.<sup>7</sup> Rather, it was supported by the

process). See, e.g., Steigerwald (2015), pp. 183, 223-24. This leads to other errors that we discuss in more detail later in this article.

<sup>5</sup>Nosal & Steigerwald (2010) p. 4. The authors explain that the Arrow-Debreu model, the foundation for modern general equilibrium analysis, assumes perfect commitment; therefore, institutional mechanisms designed to assure that traders can commit to performing their obligations cannot be explained using that model. Nor is the legal enforceability of such obligations sufficient. Anglo-American contract law, for example, traditionally offers only a legal remedy for actual damages incurred by a breach of contract. That leaves open the possibility of “strategic breach” of contract where a party anticipates that the cost of paying damages is lower than the cost of full performance.

<sup>6</sup>In particular, we note that CCPs play a unique, quasi-legislative, quasi-regulatory role in establishing rules and procedures that govern the contract obligations of both clearing members and the CCP. Tucker (2011), p. 1 (CCPs “are de facto regulators and supervisors for the markets they clear”); see also, Coase (1988), pp. 8-10 (discussing the “law making” role of exchanges and other financial market infrastructures).

<sup>7</sup>Stassen (1982), p. 826, explains that early U.S. commodity exchanges, such as the Chicago Board of Trade, were:

“[C]reated by businessmen as a commercial exchange for businessmen – grain merchants – who needed some order in a world of chaos, and some relief from a hostile judicial system which only reluctantly enforced businessmen's bargains.”

rules of the clearing associations. These rule structures were based on “collective responsibility” of clearing members and established membership standards and disciplinary mechanisms, including expulsion, to enforce commitment to the rules.

Why does this matter? A failure to understand that clearing is about commitment, not asset/liability (maturity) transformation and that CCPs are not banks leads to the application of an inappropriate paradigm for regulating CCPs – one that sees CCPs through the lens of banking regulation and, in particular, capital regulation.<sup>8</sup> As discussed in this paper, CCPs are not banks and CCP capital plays but a subordinate, yet complementary role in CCP risk management.

## Discussion

CCPs have taken on an enhanced role in the global financial system since the Financial Crisis of 2008-09 and the G20 Clearing Mandate following the Pittsburgh summit of 2009. In particular, the orderly operation and financial resilience of systemically important CCPs and other market infrastructures is now considered essential for purposes of financial stability.

This has led to an appropriate interest in the resilience of these Financial Market Utilities (FMUs) on behalf of financial regulators, resulting in efforts to strengthen the regulatory standards that apply to

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Of particular significance is the common law’s position on “difference contracts” during the late nineteenth century, when commodity exchanges and, later, clearinghouses, emerged. The common law generally considered difference contracts unenforceable “wagers.” Statutes in some states raised further barriers to enforcement, such as “. . . criminalizing the transactions and . . . granting the loser the right to recover their losses from winners”. Kreitner (2007) pp. 106-7, and see generally *ibid* at 104-125, Stout (1999), pp. 713-721.

<sup>8</sup>Confusion regarding the nature of central clearing and the financial resources that are available to CCPs is common. For example, Albanese [Undated], p. 2, argues that a bank clearing member’s contribution to a CCP’s default (or guaranty) fund is “essentially shareholder capital for the CCP which banks are required to contribute from their own equity capital.” Using an approach that mirrors the calculation of capital charges for bilateral transactions between banks, Albanese postulates a situation in which “[a]t equilibrium, a CCP would operate similarly to a bank and charge clearing members an incremental CVA adjustment to compensate for a capital deduction.”

Whatever the merits of this approach as an alternative to central clearing, it does not accurately describe central clearing as currently constituted. The structure of a CCP’s default resources is not an “inverted” version of the capital structure that is the foundation for bank resilience. It is a deliberate structure that is calculated to implement loss mutualization among clearing members in a fashion that addresses both the potential principal-agent conflict between CCPs (and their shareholders) and clearing members and the moral hazard that arises from the anticipation by clearing members that they will be relieved (by the CCP or its shareholders or the lender of last resort or the taxpaying public) of their responsibility for mutualizing tail losses.

CCPs. Notable in this effort was the inclusion of CCPs in the CPMI-IOSCO *Principles for financial market infrastructures* (PFMIs) of 2012.<sup>9</sup>

In the aftermath of the Pittsburgh G20 summit, CCPs are widely recognized as systemically significant. This has presented a challenge to many in the regulatory community. As they have searched for a framework for analyzing CCP risk, there has been a natural tendency to look for analogues to more familiar elements of the financial system. Accordingly, CCPs have been seen as akin to payment systems, central depositories and other financial institutions and the “default waterfall” that is characteristic of a CCP has been compared to collateralized debt obligations (CDOs).<sup>10</sup> [The default waterfall typically includes: (1) initial margin posted by the clearing members; and (2) mutualized financial resources.] Given their systemic significance, and the fact that they house significant risk, there has been an even greater tendency to view them as banks.

While there are aspects and risks that CCPs share with all of these elements of the financial system, it is important to understand that CCPs are ultimately none of them. This is especially significant when CCPs are viewed as banks, despite the fact that CCPs in some jurisdictions have banking licenses. Financial system policymakers are well guided when they examine and come to a clear understanding of CCPs for what they are and design regulatory tools that are relevant to CCPs. This contrasts with a tendency to use methodologies, such as regulatory capital requirements (discussed *infra*) that have been developed in response to the crisis in banking during the Financial Crisis of 2008-09. Application of such methodologies, developed for issues in banking, may well miss the fundamental difference of CCP risk profiles as compared to those of banks.

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### Why CCPs Are Not Banks

*I tell 'em that this Country is bigger than Wall Street, and if they don't believe it, I show 'em the map. – Will Rogers, 1929*

At a fundamental level, the difference between CCPs and banks begins with their business models. While both serve an intermediary function, the similarity ends there. The contrasting business models in turn drive a strong divergence in their risk profiles, which at times appear as inverse images of the other. It is this marked difference in the risk profiles that poses the greatest challenge to those who would evaluate CCPs with the methodology of bank risk management.

### ***Business Models***

Banks are *risk-takers*. In their simplest form, they intermediate deposits and short-term funding against longer-term credit provision. As a consequence, they run mismatched books: their assets from credit provision do not match their liabilities to their sources of funding. This inherent mismatch is supported by capital, and much of the regulatory effort to promote resilience in the banking industry is focused on determining the appropriate standards of capital adequacy.

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<sup>9</sup>The PFMIs were originally adopted by the Committee on Payment and Settlement Systems (CPSS), the predecessor to the Committee on Payments and Market Infrastructures (CPMI).

<sup>10</sup>See, e.g., Risk (2016).

CCPs are *risk managers*. They serve as a substituted counterparty to both sides of a transaction brought to them by their clearing members, becoming the sole principal to both buyer and seller after a transaction has been consummated and cleared. Tucker (2011), pp. 1-2. In contrast to the mismatched books of banks, CCPs run matched books. They do not take risk other than counterparty risk in connection with their role as substituted counterparty, assuming risk when a member fails to perform its obligations until such time as the position risk is either liquidated or transferred to another member.<sup>11</sup> Margins and mutualized default resources from clearing members largely support the temporarily mismatched exposure of CCPs.

Unfortunately, the implications of counterparty substitution are often misunderstood. In particular, there is a tendency in the academic and policy literature to consider the clearinghouse a mere agent of the original counterparties to cleared trades – rather than a principal to those trades. The CCP, conceived as a clearing agent rather than a contract principal to cleared trades, is thus imagined to be an intermediary that stands between the parties to the trade, acting as a “backstop” in the event that one or the other of the counterparties fails to perform its obligations.<sup>12</sup> This betrays a fundamental misconception of central clearing – a misconception that we refer to as the “persistence of the bilateral.” As discussed in the introduction to this article, that bilateral relationship is irrevocably terminated by novation (or an equivalent legal process) upon the acceptance of a trade for clearing.

6 For example, Ghamami (2015), p. 10, considers an example in which a pair of clearing members holding offsetting “long” and “short” interest rate futures positions. He claims that “[i]f both clearing default at the same time, the CCP . . . would not incur any direct losses.” That would be true if the clearing members were counterparties to a bilateral, uncleared trade, because their obligations would be mutual and offsetting. For cleared trades, however, the original trade counterparties no longer have any continuing relevance (in fact, they may have been replaced by others facing the CCP). Counterparty substitution by novation (or other legal mechanisms, such as “open offer”) terminates the mutual relationship between the original counterparties. Of course, the simultaneous default of two clearing members that face a CCP with offsetting positions might leave the CCP without any loss, but such a situation would likely be extremely remote.

The incomplete recognition of the implications of counterparty substitution results in a conception of a CCP as an insurer, rather than a principal to cleared trades. The clearing members who originate cleared trades do not continue in a bilateral contractual relationship with their trade counterparties once those trades are accepted for clearing. They are replaced by the CCP as substituted principal for both sides of those trades and retain an interest, beyond their margin obligations, only insofar as they remain contingently responsible for mutualizing losses in the event any of the clearing members default.

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<sup>11</sup>Cœuré (2015) explains that “CCPs are not leveraged and . . . do not actively take risk: barring the default of a member or an operational incident, their net risk exposure at any point in time is always equal to zero.”

<sup>12</sup>See, e.g., Litan (2011), p. 5, n. 2 (CCP “acts as the legal go-between for the buyer and the seller”); Lo (2012), p. 21 (CCP is “a legal entity that serves as an intermediary between two counterparties so that if either one defaults on its obligation, the clearinghouse will fulfill that obligation”); Skeel (2011), pp. 5, 69-70 (describing central counterparty clearing as a “backstop” to and “middleman” between the trade counterparties).

A related misunderstanding treats central counterparty clearing primarily as an insurance function.<sup>13</sup> Loss mutualization among the clearing members of a CCP is, of course, a core feature of central counterparty clearing and loss mutualization is a common means by which members of a clearinghouse (and other membership associations) provide “self-insurance” for their activities. But central counterparty clearing does not employ the usual mechanisms of insurance – risk “pooling” and diversification.

### ***Risk Profiles***

In their more sophisticated form, banks are involved in other lines of risk-taking, including principal investing, securities underwriting, capital markets and treasury services and securities, derivatives, foreign exchange, energy and commodities market making. All of these activities expose banks to a wide range of counterparty risk and all require capital support.

Governance of bank risk-taking is formal, with key oversight by bank boards of directors of the nature of the risks, and the magnitude of those risks, being undertaken on a principal basis. A major driver of this is consideration of risk vs. return. See, e.g., U.S. GAO (1998), pp. 73-74.

CCPs may clear a wide or narrow range of market products. Their risk resources are primarily a mixture of contributions from members. Initial margin is required from all members to support positions. At least daily, sometimes intraday, variation margin is required from all clearing members holding positions with adverse marks to market and maintain initial margin levels. The margin regime in turn is backstopped by a default fund provided by all clearing members, and in some cases, unfunded assessment powers provided by non-defaulting clearing members. This mutualization of risk by the clearing members may also be enhanced by contributions of CCP capital in the case of a demutualized CCP.

Governance of CCP risk is fundamentally different than that of banks, as it is shared as a result of loss mutualization. Because risk is mutualized, clearing members and the CCP both participate in risk decisions, usually through a risk committee that includes representatives of members. Mutualization of risk is indeed a key distinguishing feature of CCP risk management as compared to bank risk management.

Both banks and CCPs face significant aspects of risk: credit, liquidity, operational and systemic. Hughes & Manning (2015), p. 73; Hughes & Manning (2016), p. 14; see also, Lin & Surti (2013), p. 5. Banks, as noted, intermediate between short-term funding and long-term credit provision, with exposure that can extend into decades. CCPs have credit exposures when a member defaults, and with a rigorous margin regime can measure exposure to clearing members in intraday or at most overnight terms.

Banks face liquidity risk when current obligations to pay cannot be met by liquidation of assets, a possible consequence of intermediating between short-term funding and long-term credit provision. Central banks have long recognized this potential problem and stand as “lenders of last resort” against good collateral to provide banks with sufficient liquidity.

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<sup>13</sup>See, e.g., Koepl & Monnet (2010), p. 3; see also: Fontaine, Pérez-Saiz, & Slive (2012), p. 15 (“risk sharing in the CCP provides benefits from diversification similar to those created by an insurance company”).



CCPs face liquidity risk in the event of a member default and having the obligation to pay variation margin in cash. Many CCPs have committed liquidity facilities to allow them to convert securities held as margin or default fund investments into cash, though with a possible element of *wrong-way risk* if the failed member is in the liquidity facility. Some central banks have provided for credit access for CCPs. A clearing member's failure to pay will cause a default *at* the CCP; the CCP's inability to pay its members can result in the default *of* the CCP. Arguably, this may be the greatest risk to a CCP: even if it has adequate margin collateral from the defaulter and other mutualized resources, it may not be able to make timely payments to surviving clearing members as a result of systemic liquidity issues.

Banks and CCPs both face the risk of insolvency as a result of credit losses or liquidity constraints. For banks, the mismatch between assets and liabilities can mask solvency, as the value and liquidity of longer dated credit assets can be difficult to ascertain or realize. This can be ameliorated by central bank liquidity provision (secured by good collateral). Access to liquidity provision may allow the bank to continue to operate unless authorities determine that the bank is insolvent place it into resolution. For CCPs, solvency risk is an extreme tail event, characterized by the failure to reestablish a matched book causing the default management resources of margin collateral, default fund and assessments to be overwhelmed by obligations to pay, or an extended inability to pay due to a failure to convert good margin or default fund collateral into cash.

## Capital and Collateral in Periods of Stress

Further distinctions between banks and CCPs can be observed in the respective roles and effects of capital and collateral.

Before we begin, we wish to make a distinction between initial margin and collateral. Initial margin is a *requirement*, rigorously calculated by CCPs, to be held against a member's obligations to perform on the changes in value of positions held. Collateral is the *instrument* posted at the CCP to meet the initial margin requirement, typically high quality liquid securities or cash.

CCP initial margin requirements are determined largely by market risk considerations, including price volatility, concentration and specific market liquidity. There is no consideration of the credit ratings of the clearing members or their customers. The creditworthiness of a clearing member only becomes an issue if it no longer meets membership requirements. Base margin levels (before concentration and other risk "add-ons") are applied uniformly to all members.

Variation margin at CCPs is paid with cash, and reflects changes in the position values based on new marks-to-market. Collected from those who have lost due to the new marks, variation margin is in turn paid by the CCP with finality to those who have won. The failure to pay variation margin is the most likely cause of a member's default, and highlights an important liquidity risk of members.

As we have noted, CCPs run matched books – reflecting the perfect synchronization of "long" and "short" positions cleared by the CCP. The matched book is not reflected on the CCP's balance sheet. It is a reflection of the principal risk position the CCP undertakes as the substituted counterparty to all trades accepted for clearing.

A CCP's book will become unmatched and the CCP will face market risk in the event of a clearing member default. The defaulting member's margin collateral and mutualized resources are available to the CCP to be used as necessary and the CCP will take steps to restore the matched book. This has no capital impact on the CCP. The CCP's balance sheet, unlike that of a bank, will not reflect either the steps taken to restore the matched book or the use of the defaulter's margin collateral or, if necessary, mutualized

financial resources. Cœuré (2015) (discussing “the limited extent to which CCPs are expected to cover their exposures via their own funds”)

By contrast, capital supports the mismatched books run by banks. Capital is essentially a balance sheet concept. Capital adequacy requirements are imposed on banks and some other financial institutions to provide a buffer against loss, to protect creditors in the event a bank fails, and for related regulatory purposes. Tarullo (2008), p. 16-29; Berger, Herring & Szegö (1995).<sup>14</sup> This generally means that equity and other junior claims on a bank are residual claims that are available to support the ongoing operations of the bank and meet creditor claims if the bank is forced into resolution. Moreover, a bank’s capital is “usually difficult to redeem during a financial crisis, mitigating systemic risk problems and buying time for regulators to deal with the crisis.” Berger, Herring & Szegö (1995, p. 30). Bank capital, however, is not a liquid asset to be liquidated in the event of distress (indeed, capital appears on the liability side of the bank’s balance sheet).

For example, a bank may become distressed as a result of large portfolios of non-performing loans. Under applicable accounting and regulatory requirements, the bank may be required to write down the balance sheet value of these assets. As a result, the bank must also write down the amount of its equity capital, the residual claim to which shareholders are entitled. The bank’s balance sheet is thus restored to balance – the total of assets equals the sum of liabilities. The bank may also sell illiquid assets (to raise more liquid assets) or raise new capital to improve its capital position. The resulting changes in the mix of the bank’s assets, liabilities and capital will be reflected on the bank’s balance sheet.

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A bank’s balance sheet is an essential source of information to the bank’s creditors and other regarding the bank’s financial condition. In particular, it provides an indication to creditors and regulators alike concerning the ability of the bank to meet its ongoing obligations as they fall due. Moreover, it signals whether there is a sufficient capital buffer that can be used to meet the claims of senior creditors in the event the bank fails.

A CCP’s balance sheet does not, and cannot, perform these functions. Critically, CCPs have obligations to their clearing members who are direct contract counterparties to the CCP. They care about the ability of the CCP to meet its obligations to them as principal to those obligations. As long as the CCP maintains a matched book, there is no doubt about its ability to meet its obligations to clearing members, leaving aside the possibility of non-default sources of distress, which we do not discuss in this paper.

The use of margin collateral and other resources, as opposed to CCP capital, in managing default is inextricably tied to the nature of the risk faced by a CCP and the CCP’s function as a commitment mechanism. This has important implications for the incentives of the CCP (and its owners and managers) and clearing members. This effect may be subtle and depend on the circumstances.

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<sup>14</sup>Tarullo (2008), p. 17, explains that “[i]n the absence of a dependable third-party guarantee, lenders want assurance that a borrower will be sufficiently solvent and liquid to repay its debt in accordance with the contractual terms of the loan, bond, or other extension of credit.” Furthermore, Berger, Herring & Szegö (1995), pp. 16-17, explain that “[r]egulators require capital for almost all the same reasons that other uninsured creditors of banks ‘require’ capital -- to protect themselves against the costs of financial distress, agency problems, and the reduction in market discipline caused by the safety net.”

The Basel Committee on Banking Supervision notes that “[b]oth capital and margin perform important and complementary risk mitigation functions but are distinct in a number of ways.” BIS, BCBS (2015). Most importantly, this involves the difference between so-called “defaulter-pay” and “survivor-pay” risk management mechanisms.

The Basel Committee explains:

First, margin is “defaulter-pay”. In the event of a counterparty default, margin protects the surviving party by absorbing losses using the collateral provided by the defaulting entity. In contrast, while capital adds loss absorbency to the system, because it is “survivor-pay”, using capital to meet such losses consumes the surviving entity’s own financial resources. The shift towards greater reliance on margin will have a useful influence on incentives. Greater reliance on margin will help market participants to better internalise the cost of their risk-taking, because they will have to post collateral when they enter into a derivatives contract. It will also promote resilient markets in times of stress, when a market participant who has not received margin could be under pressure to withdraw from trading to preserve its capital.

Second, margin is more “targeted” and dynamic, with each portfolio having its own designated margin for absorbing the potential losses in relation to that particular portfolio, and with such margin being adjusted over time to reflect changes in that portfolio’s risk. In contrast, capital is shared collectively by all the entity’s activities and may thus be more easily depleted at a time of stress. It is also difficult to rapidly adjust capital in response to changing risk exposures. Capital requirements against each exposure are not designed to cover the loss on the default of the counterparty but rather the probability-weighted loss given such default. For these reasons, margin can be seen as offering enhanced protection against counterparty credit risk provided that it is effectively implemented. In order for margin to act as an effective risk mitigant, it must be (i) accessible when needed and (ii) provided in a form that can be liquidated rapidly and at a predictable price even in a time of financial stress.<sup>15</sup>

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<sup>15</sup>BIS, BCBS (2015), p. 4. The relevant literature recognizes that “defaulter-pays” resources are critical to the incentive structure embedded in a CCP default waterfall. See, e.g., Haene & Sturm (2009); Nahai-Williamson, Ota, Vital, & Wetherilt (2013). In particular, Haene and Sturm (2009), pp. 4-5, explain how the combination of “defaulter-pays” and “survivor-pays” mechanisms affect the incentives of CCP clearing member:

First, to the extent that participants’ access to collateral is limited, margin requirements put a cap on trading positions and consequently on the maximum loss a participant can incur for the CCP [Citations omitted]. Second, as in the case of other insurance mechanisms, a collective default fund might lead to moral hazard problems by creating less incentives for a participant to avoid default, as the cost of the default is partially borne by the other participants through their default fund contributions [Citation and note omitted]. At the same time, the need to deposit margins in relation to current risk exposures is likely to limit a participant’s leverage and risk-taking, thereby lowering its default probability. Therefore, *ceteris paribus*, increasing the relative importance of margin requirements in the CCP’s risk management framework might decrease both the likelihood of and the size of the potential loss in case of a participant’s default.

CCPs have established contractual mechanisms in the form of margin requirements and mutualized resources to manage a member default. These mechanisms have been carefully thought out and evolved over more than a century of experience with central counterparty clearing on a global basis. These mechanisms have generally performed very well<sup>16</sup> and perform risk management functions, including incentive alignment, that capital alone cannot.

### ***Policy Implications***

*1. CCP capital cannot be the primary (or a significant) resource for loss absorption without fundamentally altering the incentive structure embedded in the default waterfall*

Why? Because altering the amount of CCP capital to take a significant role, or altering its placement in the default waterfall structure would change the incentives of the parties. Were the CCP capital in the waterfall to become significant, it would come at the expense of diluting the mutualized risk characteristic of the CCP, which in turn could provide a disincentive to members to support the necessary process of liquidating a failed member's positions. This would, in effect, represent a fundamental change in the business model of the CCP. As Cœuré (2015) points out, CCP capital would need to be dramatically increased from current levels "in order to represent any meaningful part of the default waterfall." This, in turn, would "completely chang[e] the size of CCP balance sheets and their business models."<sup>17</sup>

*2. Since CCP capital is not the primary resource for loss absorption, capital analysis alone tells us little or nothing about CCP resilience*

Total loss absorbing capacity (TLAC), a concept that has been developed by bank regulators in the wake of the Financial Crisis, is largely a capital-based requirement. TLAC is different from CCP loss absorbing capacity. Gracie (2015); see also, BIS, BCBS (2016). Default loss absorption is relevant to CCP resilience and must be measured by the total of all financial resources available to the CCP -- which critically includes defaulter collateral as the primary resource.

There is no simple analogy between a CCP and a bank with respect to the roles of capital and collateral -- they serve different purposes. Banks use their own capital and any collateral pledged by borrowers for purposes of asset and liability maturity transformation. CCPs primarily use clearing member collateral (both in the form of margin and default fund contributions) in addition to a pre-specified amount of the CCP's capital to assure commitment and provide for the mutualization by clearing members of any tail losses. Commitment to full performance of open trade obligations is the key to understanding CCPs and their default resources. CCAR and TLAC tell us about bank risk and the adequacy of capital to absorb

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<sup>16</sup>See, e.g., Kroszner (2009); Kroszner (2006), p. 37. The few situations in which CCPs failed to perform well did not meet current international standards for effective risk management. Cox (2016); Norman (2010).

<sup>17</sup>In addition, Cœuré (2015) observes that "[t]his could even defeat the purpose of mandatory central clearing by pushing CCPs to dramatically increase the cost of clearing, or to compromise on their risk management in order to retain profitability."

that risk; something else is needed to identify risks and measure the adequacy of the resources to manage CCP risk.

### Contrasting Risk Profiles Under Stress

Default management is the process by which a CCP handles a member's default. This will involve liquidation of the member's positions in order to reestablish a matched book, and if willing non-defaulting members can be found to accommodate, transferring the positions and collateral of customers. The CCP funds the payments of variation margin due to the non-defaulting members by first using the resources (margin and default fund contribution) of the defaulting member. Should these prove inadequate, the remaining default management resources, comprising the CCP's committed capital and the default fund, and if necessary, assessment powers will be used to cover any shortfall.

CCP recovery is the rules-based process that begins only when the committed resources of the CCP are insufficient, and essentially addresses the distribution of the remaining losses.<sup>18</sup>

The risk profile of a bank is different. The risk management and recovery tools used by CCPs are not available to banks.<sup>19</sup> For example, a bank must deal with a non-performing loan in accordance with the terms and conditions under which the loan was extended. If the borrower is "in bankruptcy," these contract rights will be subject to applicable insolvency law. Moreover, the rights of depositors cannot be unilaterally terminated by a bank that is insolvent. This feature of the basic demand deposit contract is crucial to understanding bank runs. A bank facing a run can suspend depositor withdrawals, but not alter its obligations to depositors. Aside from the protections afforded by deposit insurance, any alteration of depositor claims must take place in the resolution process. The bank's creditors are dependent ultimately on the capital of the bank as the source of any recovery in respect of their claims.

There are, however, some similarities between "bail-in" for purposes of bank recovery and typical CCP default management and recovery practices. For example, the basic objectives of both CCP and bank recovery are similar. Hughes & Manning (2015), p. 76; Hughes & Manning (2016), p. 20.<sup>20</sup> Moreover, Cœuré (2015) notes that "the concept of 'bail-in' is directly built into [CCP] risk management" and "is achieved to a very large extent via pre-funded resources provided by the clearing members themselves."

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<sup>18</sup>See also, CPMI-IOSCO (2014) p. 3 (noting that recovery "concerns the ability of an FMI to recover from a threat to its viability and financial strength so that it can continue to provide its critical services without requiring the use of resolution powers by authorities").

<sup>19</sup>In the wake of the crisis, banks and certain non-bank financial institutions are required to prepare and submit for regulatory review their plans to undertake the capital and/or liquidity actions that may be necessary to recover from losses and restore financial viability in the face of stress. See, e.g., E.U. BRRD (2014), p. 344; FSB (2014). The primary focus of such recovery efforts is to "bail-in" investors and other creditors of a bank or non-bank financial institution. See, e.g., FSB (2014), pp. 47-48 (recovery includes "voluntary restructuring of liabilities through debt-to-equity conversion"); PriceWaterhouse Coopers (2014), p. 2.

<sup>20</sup>For example, & Manning (2015), p. 76, explain that "[t]he basic objectives in both cases are the preservation of financial stability and continuity of critical functions and services, while avoiding recourse to public funds." See also, Hughes & Manning (2016), p. 20.

The process by which clearing members are contractually obliged to participate in CCP recovery, however, is completely different from the conversion of debt to equity that may facilitate the recovery of a bank.<sup>21</sup> Accordingly, Cœuré (2015) ultimately concludes that “[t]he statutory tools implemented by banking supervisors for ensuring the resilience of banks may . . . not be appropriate for CCPs, and we should be cautious about any comparisons we make. They could be misleading.” Cœuré (2015).

The fact that CCPs have extraordinary default management and recovery powers is widely recognized as an internal, private-sector mechanism. Duffie (2015). There is no similar process outside of bankruptcy for banks to manage their obligations to creditors.

## CCP Resolution Compared to Bank Resolution

Bankruptcy is a means of “market exit” for underperforming business enterprises, but this involves externalities for banks and other systemically important financial operations. As a result of their unavoidable exposure to liquidity risk, policymakers today generally consider banks “special” and unlike ordinary business firms.<sup>22</sup> For example, policymakers have developed various “safety nets,” such as deposit insurance, in an attempt to limit the systemic consequences of bank liquidity crises. Similarly, insolvent banks, unlike ordinary corporations and other business entities, are subject to resolution under procedures that generally are designed to deal both with creditors’ rights and with the systemic consequences of the insolvency.<sup>23</sup>

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The prevailing political dogma of the Group of Twenty (G-20) leaders following the financial crisis makes clear that policymakers will allow systemically important financial institutions, including banks, to be wound up if they are insolvent and cannot find a private sector solution. In the contemporary political environment, no bank and no CCP is “too-big-to-fail.” However, the clear policy preference is to maintain the continuity of service of a CCP in trouble – presumably because of the recognized externalities associated with the disorderly wind-up and liquidation of a failing CCP. This is similar to the interconnectedness of a major, “globally significant,” bank or other financial institutions, especially those that provide access to systemically important payment, clearing or settlement services. See, e.g., FSB (2013).<sup>24</sup>

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<sup>21</sup>As Tucker (2011), p. 3, points out, “a distressed bank gets ‘recapitalised’ in some way through a reconstruction of its liabilities.” Unlike banks, “CCPs do not issue debt, so there is not obviously an economic equivalent of recapitalisation by way of haircutting the debt claims of bondholders.” See also Duffie (2013), p. 257, (CCPs do not have a “large class of unsecured creditors to absorb losses”).

<sup>22</sup>See, e.g., Kambhu, Schuermann & Stiroh (2007), p. 1.

<sup>23</sup>See, e.g., Hüpkes (2003). Most jurisdictions have bankruptcy procedures that treat the insolvency of banks and ordinary business corporations differently. Nevertheless, there are important differences among jurisdictions regarding the role that bank regulators, deposit insurers and others may play in connection with bank resolution.

<sup>24</sup>For example, Tucker comments that:

As with any business activity, if an institution is insolvent or otherwise cannot pay its debts, it has to stop trading, close and go into liquidation. That can be a disastrous course for a major financial institution at the very heart of important capital markets. Policy in this general area revolves around building regimes that avoid taxpayer solvency support

Why is this distinction important? There are many banks and many substitutes for the basic services provided by even the largest, most interconnected banks. In contrast, there are few substitutes for most systemically important CCPs and open positions cannot easily be transferred to a different CCP.<sup>25</sup> As a result, the disorderly failure of a systemically important CCP would have immediate and widespread consequences for participants in cleared markets.

Banks, being risk takers by nature, are vulnerable to failure, especially in periods of high stress. There were 165 bank failures in the United States during 2008-09.

CCPs, being risk managers, can fail, but failure is rare. There have been three since 1974, in Paris, Kuala Lumpur and Hong Kong, the last being in 1987, and none in the United States. Modern CCP risk management practices and the mutualization of risk by members were largely absent from the three failures. CCPs had generally evolved to a reasonable degree of resilience well before the PFMI were circulated in 2012.

Consistent with international policy practice, we define CCP resolution as the entry of an external authority, with legal authorization, into the process of managing a failing CCP. Some resolution authorities may enter before recovery is completed in order to utilize the dwindling resources available to the CCP. The failed (or failing) recovery would be indicative of the inability or the unwillingness of the surviving clearing members to work with the CCP's management to resolve the crisis. This would most likely be accompanied by the persistence of an unmatched book due to the CCP's inability to liquidate the failed member's positions. While the use of recovery tools from the CPMI-IOSCO recovery toolbox may be contemplated, it is the presence of the authority that distinguishes resolution from recovery.

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CCP resolution can have different outcomes. One might be the temporary maintenance of market function to allow for an orderly wind down of positions. This would be possible only if there was a substitute CCP offering comparable clearing of identical products – and this might not necessarily be the case. Another outcome could be the “tear up” of the positions at the CCP – perhaps the least desirable outcome to both regulators and clearing members as the loss of positions would unleash market contagion. A third outcome would be the rehabilitation of the CCP in order to assure continuation of service.

Banking regulators in particular should be concerned about the potential impact of systemic shock in a CCP resolution that results in tear up. They should also be concerned earlier in the process, if a bank clearing member's default triggers the CCP crisis. It may well be in the bank resolution authority's best interest to preserve the failing bank's positions at the CCP – likely to be hedges – in order to more smoothly manage the failing bank's overall risk in resolution. To do so would mean assuring that the

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but are less disruptive than orthodox corporate liquidation. In the banking sphere, where a great deal of work is underway internationally, this is known as ‘resolution’.”

Tucker (2011), p. 3.

<sup>25</sup>Hughes & Manning (2015), p. 76, explain that “given the lack of substitutability of a CCP, continuity of service and the ability to continue to meet contractual obligations to participants on time are particularly prominent considerations [in CCP recovery], as is the short time horizon over which such obligations are typically due.” The authors emphasize that “a CCP has to deal with a participant default over a very short liquidation horizon and therefore needs to have clear ex ante-defined loss and liquidity allocation procedures established in its rules.” Hughes & Manning (2016), pp. 20-21.

failing clearing member does not default at the CCP. Indeed, the most important factor in CCP resilience may well be the resilience of a CCP's bank members.

## Stress Testing

Bank regulators have made great strides in devising and implementing stress test for banks as a means of evaluating their ability to withstand various permutations of systemic stress and shock. Most of this testing is aimed at assessing capital adequacy. As the IMF staff points out, these tests “are mainly focused on solvency, are designed as traditional balance sheet-based stress tests, and apply some form of static balance sheet assumption.” IMF (2012).

Many wish to apply this methodology to CCPs, given their recently recognized systemic significance.

We offer a few observations for consideration.

CCPs face capital requirements for operational risk and most CCPs place some of their capital in the default waterfall, usually ahead of the non-defaulting clearing members' portion of the default fund. The amounts are generally more symbolic, as a demonstration of their faith in their margin regime, than systemically significant. Cox (2015a). As discussed above, making CCP capital a significant part of mutualized default resources would dilute the incentives of clearing members to support the liquidation or reallocation of a failed member's positions. Running a stress test, to ascertain capital adequacy as in banking, is of little meaning for a CCP. Consequently, CCPs run continuous stress test to ascertain the adequacy of their prefunded default resources.

Some banking regulators, perplexed by what is seen as an idiosyncratic balance sheet of CCPs, have sought to “convert” a CCP balance sheet into a bank balance sheet look-alike, replete with bank style capital, in order to run the equivalent of bank stress tests. Why convert actual risk metrics into capital equivalents that are not, in fact, equivalent?

There is a potential role, however, that regulators could play with CCP stress testing. CCPs have sharp focus on the risks that they manage, and the stress testing is generally robust for considerations within their world. They are not equipped, however, to test the impact of their failure on the financial system as a whole nor are they equipped to assess the potential contagion effect on other members of a given member's failure. Given that the most significant members at the world's major CCPs are banks, systemic stress testing by the financial regulators that includes CCPs would seem in order.<sup>26</sup>

## Conclusion

CCPs have unique risk profiles as compared to other market infrastructures and banks. Importantly, CCPs are managers of risk, not takers of risk. In contrast to banks, CCP capital is not significant in providing for default management resources. Rather, a combination of initial margin collateral and mutualized resources from clearing members is the primary support for the CCP's loss absorption capacity in the

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<sup>26</sup>For example, Constâncio (2016), p. 55, notes that a “proper macroprudential stress test” of CCPs “should not only include solvency and liquidity stress but also account for the interconnectedness via common exposures to clearing members as well as possible knock-on effects on the banking sector that could arise in case the guarantee fund of a CCP is wiped out and clearing members are required to cover the CCP losses.”



event of a member default. CCPs also have unique default management and recovery tools that are not available to banks.

For public policymakers addressing issues of CCP risk management and resilience, the challenge is to construct policy features that accurately incorporate the unique features of CCP risk profiles. Prudential regulators may also be able to enhance understanding by stress testing CCPs in a broader, systemic context.

## REFERENCES

**Albanese, Claudio**, [Undated], “The Cost of Clearing,” Working Paper, available at: <https://ssrn.com/abstract=2667518> or <http://dx.doi.org/10.2139/ssrn.2667518>

**Bank for International Settlements, Basel Committee on Banking Supervision**, 2015, TLAC Holdings, Consultative Document (November), available at: <http://www.bis.org/bcbs/publ/d342.pdf>

--- 2015, *Margin requirements for non-centrally cleared derivatives* (March), available at: <http://www.bis.org/bcbs/publ/d317.pdf>

**Bank for International Settlements, Committee on Payment and Settlement Systems & Technical Committee, International Organization of Securities Commissions**, 2014, *Recovery of financial market infrastructures* (August), available at: <http://www.bis.org/cpmi/publ/d121.pdf>

--- 2012, *Principles for financial market infrastructures* (April), available at: [www.bis.org/publ/cpss101a.pdf](http://www.bis.org/publ/cpss101a.pdf)

17

**Bank for International Settlements, Committee on Payments and Market Infrastructures and International Organization of Securities Commissions (CPMI-IOSCO)**, 2016, *Resilience and recovery of central counterparties: Further guidance on the PFMI* (Consultative Report, August), available at: <http://www.bis.org/cpmi/publ/d149.pdf>

**Berger, Allen N., Richard J. Herring, & Giorgio P. Szegö**, 1995, “The Role of Capital in Financial Institutions,” Wharton School Center for Financial Institutions, Working Paper No. 95-01 (January), available at: <http://fic.wharton.upenn.edu/fic/papers/95/9501.pdf>

**Board of Governors of the Federal Reserve System**, 2009, Order Approving Application for Membership (March 4), available at: <https://www.federalreserve.gov/newsevents/press/orders/orders20090304a1.pdf>

--- 1996, Order Approving a Notice to Engage in Certain Nonbanking Activities and Application to Become a Member of the Federal Reserve System (December 4), available at: [www.federalreserve.gov/boarddocs/press/bhc/1996/19961204/#f9/](http://www.federalreserve.gov/boarddocs/press/bhc/1996/19961204/#f9/).

**Budding, Edwin, Robert T. Cox, & David Murphy**, 2016, “Central counterparties in crisis: International Commodities Clearing House, New Zealand Futures and Options Exchange and the Stephen Francis Affair,” *Journal of Financial Market Infrastructures*, Vol. 4, No. 3 (March), pp. 65-92

**CME Group, Inc. The Depository Trust & Clearing Corporation, Intercontinental Exchange, Inc., and The Options Clearing Corporation**, Letter to the Chairman, Financial Stability Oversight Council, re: U.S. Regulatory Oversight of Central Counterparties (March 9, 2015), available at: [https://www.theice.com/publicdocs/CME\\_DTCC\\_ICE\\_OCC\\_Letter.pdf](https://www.theice.com/publicdocs/CME_DTCC_ICE_OCC_Letter.pdf)

**Coase, Ronald H.**, 1988, *The Firm, the Market and the Law* (Chicago: U. of Chicago Press)

**Cœuré, Benoît**, 2015, Ensuring an adequate loss-absorbing capacity of central counterparties,” Remarks at the Federal Reserve Bank of Chicago 2015 Symposium on Central Clearing, Chicago (10 April), available at: <https://www.ecb.europa.eu/press/key/date/2015/html/sp150411.en.html>

**Constâncio, Vítor**, 2016, “The role of stress testing in supervision and macroprudential policy,” in Ronald Anderson (ed.), *Stress testing and macroprudential regulation: A transatlantic assessment*, Centre for Economic Policy Research (CEPR), available at: [http://voxeu.org/sites/default/files/Stress\\_testing\\_eBook.pdf](http://voxeu.org/sites/default/files/Stress_testing_eBook.pdf)

**Corrigan, E. Gerald**, 1983, “Are Banks Special?,” Federal Reserve Bank of Minneapolis, Annual Report (January 1), available at: <https://www.minneapolisfed.org/publications/annual-reports/are-banks-special>

**Cox, Robert**, 2015b, “Central counterparties in crisis: the Hong Kong Futures Exchange in the crash of 1987,” *Journal of Financial Market Infrastructures*, Vol. 4, No. 2 (December)

--- 2015a, “*Cave quid optes*: waterfalls and central counterparty capital,” *Journal of Financial Market Infrastructures*, Vol. 3, No. 4 (June)

**Cox, Robert T., & Robert S. Steigerwald**, 2016, “‘Incomplete demutualization’ and financial market infrastructure: central counterparty ownership and governance after the crisis of 2008-9,” *Journal of Financial Market Infrastructures*, Vol. 4, No. 3 (March)

**Duffie, Darrell**, 2015, “Resolution of Failing Central Counterparties,” in Kenneth E. Scott, Thomas H. Jackson & John B. Taylor, *Making Failure Feasible, How Bankruptcy Reform Can End “Too Big to Fail,”* (Stanford, CA: Hoover Institution Press); Working Paper (December 17, 2014), available at: <http://www.darrellduffie.com/uploads/working/DuffieCCP-ResolutionJan2015.pdf>

--- 2013, “Replumbing Our Financial System: Uneven Progress,” *International Journal of Central Banking*, Vol. 9, No. 1, available at: <http://www.ijcb.org/journal/ijcb13q0a12.pdf>

**Financial Stability Board**, 2013, *Recovery and Resolution of Systemically Important Financial Institutions: Guidance on Identification of Critical Functions and Critical Shared Services* (July 16), available at: [http://www.fsb.org/wp-content/uploads/r\\_130716a.pdf](http://www.fsb.org/wp-content/uploads/r_130716a.pdf)

**Fontaine, Jean Sébastien, Héctor Pérez-Saiz & Joshua Slive**, “Access, Competition and Risk in Centrally Cleared Markets,” *Bank of Canada Review* (Autumn 2012), available at: <http://www.bankofcanada.ca/wp-content/uploads/2012/11/bod-review-autumn12-fontaine.pdf>

**Ghamami, Samim**, 2015, “Static Models of Central Counterparty Risk,” Forthcoming in the *Journal of Financial Engineering* (April 19), available at: <http://cdar.berkeley.edu/wp-content/uploads/2015/10/Ghamami-StaticModels.pdf>

**Gorton, Gary B.**, 2014, “The Development of Opacity in U.S. Banking,” *Yale Journal on Regulation*, Vol. 31, pp. 825, et seq., available at: <http://digitalcommons.law.yale.edu/yjreg/vol31/iss3/9>

**Gracie, Andrew**, 2015, “CCP resolution and the ending Too Big to Fail agenda,” Remarks at the 21<sup>st</sup> Annual Risk USA Conference, New York (22 October), available at: <http://www.bankofengland.co.uk/publications/Documents/speeches/2015/speech871.pdf>

**Haene, Philipp, & Andy Sturm**, 2009, “Optimal Central Counterparty Risk Management,” Swiss National Bank Working Paper No. 2009-7 (June), available at: <https://www.newyorkfed.org/medialibrary/media/research/conference/2009/money-payments/5-Haene-Sturm.pdf>

**Hughes, David, & Mark Manning**, 2015, “CCPs and Banks: Different Risks, Different Regulations,” Reserve Bank of Australia, *Bulletin* (December Quarter), available at: <http://www.rba.gov.au/publications/bulletin/2015/dec/pdf/bu-1215-8.pdf>

--- 2016, “Central counterparties and banks: vive la difference,” *Journal of Financial Market Infrastructures*, Vol. 4, No. 3 (March), pp. 1-24

**Hüpkes, Eva**, 2003, “Insolvency – why a special regime for banks?,” in *Current Developments in Monetary and Financial Law*, Vol. 3 (Washington D.C.: International Monetary Fund)

**International Monetary Fund**, 2012, “Macrofinancial Stress Testing—Principles and Practices (August 22), available at: <http://www.imf.org/external/np/pp/eng/2012/082212.pdf>

**Kambhu, J., T. Schuermann & K. Stiroh**, 2007, “Hedge Funds, Financial Intermediation, and Systemic Risk,” New Directions for Understanding Systemic Risk, Federal Reserve Bank of New York, *Economic Policy Review*, Vol. 13, No. 2 (December), available at: <http://fic.wharton.upenn.edu/fic/papers/07/0717.pdf>

**Koepl, Thorsten V., & Cyril Monnet**, 2010, “Emergence and Future of Central Counterparties” (September 1), Federal Reserve Bank of Philadelphia Working Paper No. 10-30, available at: <http://ssrn.com/abstract=1687862> or <http://dx.doi.org/10.2139/ssrn.1687862>

**Kreitner, Roy**, 2006, *Calculating Promises, The Emergence of Modern American Contract Doctrine* (Stanford U. Press)

**Kroszner, Randall S.**, 2009, “Making Market More Robust,” Prepared for the Alvin Hansen Symposium: *Reregulating the U.S. Financial Markets: What to Do When the Crisis is Over*, Harvard University (April 30, 2009), available at: <http://faculty.chicagobooth.edu/randall.kroszner/research/pdf/Making%20Markets%20More%20Robust%20203.pdf>

--- 2006, “Central Counterparty Clearing: History, Innovation, and Regulation,” Federal Reserve Bank of Chicago, *Economic Perspectives*, Vol. 30, No. 4 (4th Quarter), available at: <http://ssrn.com/abstract=948773>

**Lin, Li, & Jay Surti**, 2013, “Capital Requirements for Over-the-Counter Derivatives Central Counterparties,” International Monetary Fund Working Paper No. 13/3 (January), available at: <https://www.imf.org/external/pubs/ft/wp/2013/wp1303.pdf>

**Litan, Robert**, 2010, “The Derivatives Dealers’ Club and Derivatives Markets Reform: A Guide for Policy Makers, Citizens and Other Interested Parties,” Brookings Institution (April 7), available at: [http://www.brookings.edu/~media/research/files/papers/2010/4/07%20derivatives%20litan/0407\\_derivatives\\_litan.pdf](http://www.brookings.edu/~media/research/files/papers/2010/4/07%20derivatives%20litan/0407_derivatives_litan.pdf)

**Lo, Andrew W.**, 2012, “Reading About the Financial Crisis: A 21-Book Review” (January 9), available at: [http://www.argentumlux.org/documents/JEL\\_6.pdf](http://www.argentumlux.org/documents/JEL_6.pdf)

**McKinley, Vern**, 2015, “After the Crisis: Revisiting the ‘Banks Are Special’ and ‘Safety Net’ Doctrines,” Mercatus Research, Mercatus Center at George Mason University (June), available at: <http://mercatus.org/sites/default/files/McKinley-Are-Banks-Special.pdf>

**Moser, James T.**, 1998, “Contracting Innovations and the Evolution of Clearing and Settlement Methods at Futures Exchanges,” Federal Reserve Bank of Chicago, Working Paper 98-26 (August), available at: [http://www.chicagofed.org/digital\\_assets/publications/working\\_papers/1998/wp98\\_26.pdf](http://www.chicagofed.org/digital_assets/publications/working_papers/1998/wp98_26.pdf)

**Nahai-Williamson, Paul, Tomohiro Ota, Mathieu Vital, & Anne Wetherilt**, 2013, “Central counterparties and their financial resources — a numerical approach,” Bank of England, Financial Stability Paper No. 19 (April), available at: [http://www.bankofengland.co.uk/financialstability/Documents/fpc/fspapers/fs\\_paper19.pdf](http://www.bankofengland.co.uk/financialstability/Documents/fpc/fspapers/fs_paper19.pdf)

**Norman, P.**, 2011, *The Risk Controllers, Central counterparty Clearing in Globalised Financial Markets* (Chichester: John Wiley & Sons)

**Nosal, Ed, & Robert S. Steigerwald**, 2010, “What is clearing and why is it important?,” Federal Reserve Bank of Chicago, *Chicago Fed Letter*, No. 278 (September 2010), available at: [http://www.chicagofed.org/digital\\_assets/publications/chicago\\_fed\\_letter/2010/cflseptember2010\\_278.pdf](http://www.chicagofed.org/digital_assets/publications/chicago_fed_letter/2010/cflseptember2010_278.pdf)

**Risk**, “Dealers disagree over charge for CCP counterparty risk,” by Nazneen Sherif (May 11, 2016), available at: <http://www.risk.net/risk-magazine/news/2457621/dealers-disagree-over-charge-for-ccp-counterparty-risk>

20

**Saunders, Anthony**, 2015, “Is Basel turning banks into public utilities?,” *Journal of Financial Perspectives*, Vol. 3, no. 1 (March), available at: [http://www.ey.com/Publication/vwLUAssets/Journal\\_of\\_Financial\\_Perspectives\\_vol3is1/\\$FILE/EY\\_FS\\_Journal\\_Vol3\\_Issue1.pdf](http://www.ey.com/Publication/vwLUAssets/Journal_of_Financial_Perspectives_vol3is1/$FILE/EY_FS_Journal_Vol3_Issue1.pdf)

**Skeel, David A.**, 2011, *The New Financial Deal, Understanding the Dodd-Frank Act and Its (Unintended) Consequences* (Hoboken, NJ: John Wiley & Sons)

**Stassen, John H.**, 1982, “The commodity exchange act in perspective: A short and not-so-reverent history of futures trading legislation in the United States,” *Washington and Lee Law Review*, Vol. 39, pp. 825, *et seq.*, available at: <http://scholarlycommons.law.wlu.edu/wlulr/vol39/iss3/3>

**Steigerwald, Robert S.**, 2015, “Central Counterparty Clearing and Systemic Risk Regulation,” in A. Malliaris and W. Ziemba (eds.), *The World Scientific Handbook of Futures Markets*, Vol. 5 (Singapore: World Scientific Publishing)

**Stout, Lynn A.**, 1999, “Why the Law Hates Speculators: Regulation and Private Ordering in the Market for OTC Derivatives,” *Duke Law Journal*, Vol. 48, pp. 701, *et seq.*, available at: <http://scholarship.law.duke.edu/cgi/viewcontent.cgi?article=1048&context=dlj>

**Tarullo, Daniel K.**, 2008, *Banking on Basel, The Future of International Financial Regulation* (Washington, DC: Peterson Institute for International Economics)

**Tucker, Paul**, 2011, “Clearing houses as system risk managers,” Remarks at the Depository Trust & Clearing Corporation-Centre for the Study of Financial Innovation Post Trade Fellowship Launch, London (1 June), available at: <http://www.bis.org/review/r110608g.pdf>

**U.S. Government Accountability Office**, 1998, Risk-Based Capital, Regulatory and Industry Approaches to Capital and Risk, Report GAO/GGD-98-153 (July), available at: <http://www.gao.gov/assets/160/156259.pdf>