



BANK OF CANADA
BANQUE DU CANADA

Discussion Paper/Document d'analyse
2011-4

Lessons from International Central Counterparties: Benchmarking and Analysis

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Bank of Canada Discussion Paper 2011-4

June 2011

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Acknowledgements

I would like to thank all those who contributed to the realization of this paper. Specifically, I am grateful to Governor Mark Carney for giving me the opportunity and motivation to join the Bank, Bob Fay for helping me to find the right challenge, and Paul Miller for being a great mentor and for creating a stimulating work environment within the Infrastructure Policy Division. Thank you as well to James Chapman for his long-term support throughout the publication process. Additionally, I am deeply grateful to other colleagues who provided valuable comments and suggestions, including Stacey Anderson, Joshua Slive, and many others from the Financial Stability Department.

Abstract

Since the financial crisis, attention has focused on central counterparties (CCPs) as a solution to systemic risk for a variety of financial markets, ranging from repurchase agreements and options to swaps. However, internationally accepted standards and the academic literature have left unanswered many practical questions related to the design of CCPs. The author analyzes the inherent trade-offs and resulting international benchmarks for a certain set of issues. Four CCPs – FINet, CME Clearing, Eurex Clearing and LCH.Clearnet – are considered in terms of risk management, CCP links, governance and operational risk.

JEL classification: G01, G14, G18, G28, G38

Bank classification: Financial system regulation and policies; Financial stability; Payment, clearing, and settlement systems; Financial markets

Résumé

Depuis la crise financière, l'attention se porte sur les contreparties centrales, car ces entités permettraient d'abaisser le risque systémique associé à divers marchés financiers, dont ceux des pensions, des options et des swaps. Néanmoins, de nombreuses questions pratiques liées à leur conception ont été ignorées jusqu'à maintenant dans les normes internationalement reconnues et la littérature. L'auteur analyse les arbitrages inhérents à un certain nombre de questions ainsi que les critères de comparaison internationaux qui en résultent. Quatre contreparties centrales, à savoir FINet, CME Clearing, Eurex Clearing et LCH.Clearnet, sont étudiées sous les angles de la gestion du risque, des liens entre contreparties centrales, de la gouvernance et du risque opérationnel.

Classification JEL : G01, G14, G18, G28, G38

Classification de la Banque : Réglementation et politiques relatives au système financier; Stabilité financière; Systèmes de paiement, de compensation et de règlement; Marchés financiers

1 Introduction

In the wake of the financial crisis, policy-makers have focused on finding ways to mitigate counterparty credit risk, and its implications for systemic risk. In parallel, the proliferation of more complicated financial instruments such as repurchase agreements (repos) and over-the-counter (OTC) derivatives has increased the complexity of the financial landscape and forced overseers of the financial system to reconsider the current regulatory framework.

For a variety of financial instruments, the implementation of a central counterparty (CCP) has been posited as part of the solution in the global efforts to address counterparty risk and ensure that core markets continue to operate¹ even in times of stress (an explanation of a CCP's effects on counterparty risk is provided in Appendix A).

Though certain standards currently exist – for example, the CPSS-IOSCO Recommendations² – and some work on the subject has been published in the academic literature, many practical questions remain. However, existing CCPs have all at some point needed to tackle a number of difficult issues, and the resulting wealth of experience provides valuable guidance to CCP operators and policy-makers. Learning from them, through a study of global best practices, will provide greater guidance for some specific practical questions.

This study aims to provide a greater high-level understanding of global CCP best practices, and was motivated by the recently announced fixed-income CCP service that the Canadian Derivatives Clearing Corporation (CDCC) will offer in Canada.³ It is of particular relevance for financial organizations and regulators considering the implementation of a CCP.

This paper is organized as follows. Section 2 provides a macro overview of the CCP landscape by considering four CCPs that clear fixed income, repos and other financial instruments: one domestic (FINet) and three international (CME Clearing, Eurex Clearing and LCH.Clearnet). Section 3 examines their risk-management practices related to acceptable collateral, membership criteria, margin and clearing fund requirements, clearing fund loss allocation, CCP equity in the loss waterfall, short-term liquidity and default history. Section 4 addresses the emerging question of CCP links and how they are managed. Section 5 discusses governance concerns, specifically those related to the CCP's Board of Directors and risk committee. Section 6 examines operational risk and business-continuity management, with a particular focus on backup arrangements, and backup testing (Appendix B provides more details on the research approach).

¹ For more information on Canada's participation toward the G-20 commitments on OTC derivatives, see OTC DWG (2010).

² These recommendations are currently being reviewed, which will provide even further guidance on this subject. For existing recommendations, see CPSS-IOSCO (2004); for recommendations review, see BIS (2010).

³ CDCC announced a new CCP for repurchase agreements through the Investment Industry Association of Canada (IIAC 2009).

The subsections of sections 3 to 6, inclusive, discuss industry trends and provide a holistic overview of the inherent CCP dynamics. They also address some of the trade-offs, or push-pull dynamics, that CCPs must consider when designing their policies, and discuss the emerging industry signposts and global benchmarks⁴ (a summary of the actual results is included in the exhibits).

Section 7 discusses potential areas for further CPP analysis. Lastly, section 8 offers some conclusions.

2 Overview of the Four CCPs Examined

2.1 CDS – FINet

CDS Clearing and Depository Services Inc. (CDS), a non-profit entity, operates CCP services through its existing facility, FINet.⁵ FINet clears eligible fixed-income securities, mainly government debt and Canada Mortgage Bonds. Though it is open to all CDS participants, members self-elect to clear eligible trades through FINet as an alternative to bilateral clearing.

CDS is primarily user owned, including banks (66.7 per cent), the Investment Industry Regulatory Organization of Canada (15.2 per cent) and the TSX (18.1 per cent).

CDS owns and operates the CDSX, a clearing and settlement system for debt and equity securities in Canada. CDSX (and FINet, implicitly) is overseen by the Bank of Canada, the Ontario Securities Commission (OSC) and the Autorité des Marchés Financiers (AMF).

2.2 CME Clearing

CME Clearing is an important American CCP, with an annual volume exceeding one billion trades representing over US\$1,000 trillion. It clears a variety of financial products including equities, fixed income, OTC derivatives and currencies (see Appendix C). CME Clearing's proprietary software, SPAN, is an industry-leading margin calculator.⁶

CME Clearing is part of CME Group, a publicly traded company listed on the NASDAQ. CME Group is regulated primarily by the Commodity Futures Trading Commission (CFTC), and to some extent by the Securities and Exchange Commission (SEC).⁷

2.3 Eurex Clearing

Eurex Clearing is an important European CCP. It offers clearing for all traded securities in its markets, including Eurex since 1996, Eurex Bonds since 2000 and Eurex Repo since 2000 (Appendix D) (Eurex

⁴ These are not normative recommendations, industry best practices, or the author's or the Bank of Canada's suggestions.

⁵ FINet was previously called DetNet. CDS also operates a separate CCP for equities: continuous net settlement (CNS). However, since this analysis was prepared in the context of CDCC's CCP for repos, CNS is less relevant for purposes of comparison than FINet's fixed-income service.

⁶ For more detailed information, see CME (2010g).

⁷ The SEC's role has decreased pursuant to the Commodity Futures Modernization Act.

Clearing 2008b). It has over 100 clearing members (CMs) based in more than 10 countries, and in 2008 it cleared 2.3 billion transactions.⁸

Eurex Clearing is a for-profit subsidiary of Eurex Frankfurt AG, which is owned entirely by Eurex Zurich AG, whose ownership is split 50–50 between Deutsche Börse and SWX Swiss Exchange (Appendix E) (Eurex Clearing 2010e). Eurex’s main regulators are the German Federal Financial Supervisory Authority (BaFin) and the Bundesbank.

2.4 LCH.Clearnet Ltd.

LCH.Clearnet Ltd. is the U.K. subsidiary of LCH.Clearnet Group Ltd. This structure results from the 2003 merger between the London Clearing House Ltd. and the Banque Centrale de Compensation SA (Appendix F) (Standard & Poor’s 2010). The group is one of the largest CCPs in the world, clearing a variety of financial instruments including equities, commodities, fixed income, derivatives and repos. It claims to be number one in interest rate swaps, number two in fixed income and repo, and number three in futures and options (LCH 2010a).

A shareholder restructuring in 2009 increased user ownership of LCH.Clearnet Group Ltd. to 83 per cent, leaving exchanges with the remaining 17 per cent (LCH 2010b).⁹ It operates as a commercial entity. LCH.Clearnet Ltd. is regulated by the U.K. Financial Services Authority (FSA). The payment systems portion is overseen by the Bank of England.¹⁰ Its U.S. operations fall under the purview of the CFTC.¹¹ The group is regulated by Commission Bancaire in France, and in 2005 a Memorandum of Understanding was signed with other relevant national regulators, including the Netherlands, Belgium, Portugal and the United Kingdom (LCH 2009a).

3 Risk Management

Given a CCP’s inherent mandate to mitigate systemic risk, an analysis of its specific risk-management policies is paramount. Different policies and procedures work together to create a comprehensive risk-management framework. This section discusses acceptable collateral, membership criteria, margin and clearing fund requirements, clearing fund loss allocation, CCP equity in the loss waterfall, and short-term liquidity. A brief CCP default history is provided to demonstrate the veracity of default risk, and the need for strict vigilance.

⁸ More detailed information is available in Eurex Clearing (2010e).

⁹ Historically, post-merger, and prior to this recent change, LCH.Clearnet Group was owned 45.1 per cent by users, 45.1 per cent by exchanges and the balance by Euroclear (9.8 per cent) according to its pre-2009 corporate profile.

¹⁰ More information is available from LCH (2010d).

¹¹ See LCH (2009a) for internal benchmarking against standards.

3.1 Acceptable collateral

Trends (Exhibit 1: Risk Management – Acceptable Collateral)

A CCP collects collateral, in the form of margin, as a way of securing its credit exposure against a CM's potential default. A range of securities are accepted as collateral for the sampled CCPs. The focus herein is specifically on trends related to equities, bankers' acceptances, letters of credit, related-party securities and international government debt.^{12,13}

Equities range from being completely excluded (e.g., LCH) to cautiously permitted with stringent limitations (e.g., Eurex). For instance, CCPs utilize significant haircuts, concentration limits and a percentage of free float limitations. When equities are permitted, they must be from a specific, predetermined list, often a leading stock index (DJIA, S&P 500, etc.). Thus, generally, more-liquid securities issued by larger companies are pledged as CCP collateral.

Bankers' acceptances (BAs) are consistently excluded across all international CCPs.

Letters of credit (LOC) are generally excluded. However, LCH does accept performance bonds, which are structurally quite similar to LOCs, and CME accepts LOCs subject to certain limitations.

Related-party securities are similarly excluded across all CCPs. This effectively precludes pledging a company's own stock, bonds, self-issued BAs or those of related parties.

Foreign government debt is not uniformly accepted. European CCPs accept a range of debt denominations, while CME's list is much smaller. FINet accepts only domestic debt. Generally, an inverse correlation seems to exist between a North American domiciliation and the tendency to accept international debt.

Trade-Offs and Analysis

In determining collateral policies, CCPs face multiple trade-offs that have far-reaching implications.

First, there is a trade-off between conservative acceptable collateral and CM costs. Should the CCP accept only the safest and most liquid types of collateral, it effectively decreases risk. This can be done through the exclusion of certain types of collateral (e.g., equities or BAs), or a restriction against related-party securities. However, by limiting the amount and variety of acceptable collateral, increased safety yields an increase in usage cost. For instance, Singh and Aitken (2009) note that, through the crisis, large financial institutions hoarded their higher-quality collateral. This was compounded by their clients also avoiding having their own higher-grade collateral flowing across to the financial institutions. Therefore,

¹² A variety of other forms of accepted collateral are not discussed in detail, including widely accepted domestic government debt, and more rarely accepted corporate debt.

¹³ Counter-cyclical margin requirements and haircut policies are not considered in this paper, since few benchmark data were available.

according to CMs more flexibility with respect to acceptable collateral decreases their implicit costs while concurrently increasing a CCP's risk position.

Related-party securities pose a particular systemic risk. There is a strong correlation between CM default and the posted collateral losing value (e.g., if Lehman were to post its own stock as collateral, under default its collateral would also be depressed). As a result, there is an increased probability that losses will spread to non-defaulting members or the CCP's capital.

North American CCPs (FINet and CME) accept a smaller range of foreign debt securities than their European counterparts. There are three potential reasons for this phenomenon. First, relative to the CCP's size, the domestic bond market may provide sufficient postable debt capital for CME¹⁴ and FINet,¹⁵ thus obviating the need to search broadly outside of North America. Second, the European CCPs generally cover more markets,¹⁶ which contributes to the need to accept a wider range of international debt across member states. Third, the existence of the euro allows Eurex to accept many international bonds while facing lower currency risk; for example, Eurex can accept Spanish, Portuguese and Italian government debt with less risk than either CME or FINet.

Finally, an inherent trade-off exists between the benefits of securities market development and continuity versus risk management. Accepting less-liquid instruments as collateral (e.g., BAs, LOC and low-volume equities) allows the CCP to contribute to improving market liquidity for these securities. However, by putting the needs of security market development ahead of its own safety, the CCP may impede its ability to mitigate systemic risk.

Benchmarks

A few benchmarks can be derived from the above analysis.

First, equity collateral should be subjected to a concentration limit, free float limit and minimum haircut. If equities are permitted, only specific securities from a predetermined list (e.g., a large-cap stock index) should be allowed.

Unless the local market is highly developed and liquid, BAs and LOCs should be excluded. Similarly, related-party securities should be excluded.

Foreign debt can be accepted when sourced from specific countries. This becomes increasingly beneficial when CCPs wish to access a wider variety of collateral sources (or allow international CMs

¹⁴ CME, which operates in the United States, has a much larger domestic securities market than any of the other CCPs, and thus may not need to accept as many foreign securities.

¹⁵ By scale, FINet is much smaller, with far lower margin requirements, than any of the three international comparables. Therefore, it is assumed that accepting only a smaller range of Canadian debt is sufficient, and that it does not pose an undue burden to CMs.

¹⁶ LCH.Clearnet Group Ltd. has both a U.K. and a France subsidiary. The U.K. division also offers certain U.S. CCP services. LCH.Clearnet SA has branches in Amsterdam, Brussels, Paris and Porto. Eurex clearing offers services in many countries including the United States, Germany and Switzerland.

greater choice). However, these benefits must remain balanced with the CCP's broader risk-mitigation concerns.

3.2 Membership criteria

Trends (Exhibit 2: Risk Management – Membership Criteria)

CCPs establish membership criteria to ensure that CMs have sufficient operational capacity, financial resources, legal powers and risk-management expertise that their activities do not generate unacceptable risk for the CCP and its participants. CCPs' membership criteria tend to vary in their level of openness and their relative use of qualitative requirements.

First, membership criteria tend to be either restrictive or open. Restrictive systems (e.g., CME and LCH) have high capital requirements and constrictive qualitative requirements (admitting only regulated financial institutions, requiring parental guarantees, etc.). Conversely, some CCPs employ more open membership criteria (e.g., Eurex) or different classes of membership (FINet and Eurex).

Second, international CCPs vary in their use of qualitative versus quantitative requirements. Using qualitative metrics accords the CCP some leeway to control whether specific CMs are given membership. For example, CME requires that members "demonstrate fiscal and moral integrity," and Eurex requires "experience." Conversely, the utilization of entirely quantitative requirements (capital of \$5.0 million, etc.) increases transparency but concurrently decreases a CCP's discretion.

Trade-Offs and Analysis

The relative level of openness of CCP membership requirements and the use of qualitative standards have far-reaching implications.

First, there is a trade-off between openness and risk mitigation. Open standards allow CCPs to augment volume and raise trade anonymity and user competition (since more players trade directly with the CCP than via a CM), while concurrently increasing the systemic centrality of the CCP. However, restrictive membership standards may push counterparty risk away from the CCP by forcing its CMs to transact with the smaller (non-qualifying) dealers. Though, superficially, this appears to improve the CCP's net risk position (by decreasing direct CCP exposure to smaller players, thus forcing CMs to provide a buffer), this logic may not always hold. Transferring CCP risk to CMs decreases the probability of default of any individual CM (since there are fewer, lower-risk CMs), but increases CM size and thus the consequences of any particular default.

In addition, restrictive membership criteria may increase CM market power, thereby increasing the likelihood of an oligopoly. Russo, Hart and Schönenberger (2002) suggest that, in a concentrated market, because CCPs "monitor participants' trading books, there is a risk that information will be improperly used." Similarly, forcing traders to transact via CMs will give these already oligopolistic players an additional informational advantage that could potentially be used for front running.

Finally, there is a trade-off when considering the inclusion of qualitative membership requirements. Quantitative metrics increase transparency and raise CM confidence in a rigorous, unbiased clearing infrastructure and membership-selection process. The IMF (2010) notes the importance of “clear, publicly disclosed, objectively determined” risk criteria. Conversely, qualitative requirements empower the CCP with more flexibility and control over its membership base. The trade-off between CCP flexibility and its related costs will be a recurring one; this point will be revisited in section 3.6 when default procedures are discussed.

Benchmarks

A few benchmarks can be derived from the above analysis. First, minimum capitalization levels can be used to ensure “appropriate membership.” Second, defining eligible institutions can exclude certain players (e.g., allowing exclusively banks and/or regulated investment dealers). Finally, including qualitative criteria accords the CCP some leeway and subjectivity over the membership-selection process. However, these benchmarks (“appropriate membership,” the exclusion of certain players and the amount of qualitative criteria) are policy-related questions and thus inherently market specific and regulator dependent.

3.3 Margining and clearing fund contributions

Trends (Exhibit 3: Risk Management – Coverage Ratios and Clearing Fund)

A few trends emerge when examining CCPs’ policies toward margining and clearing fund contributions.

First, coverage ratios, the percentage of losses that are covered by the defaulter’s margins, are generally high across the sample set. Coverage for all three international CCPs exceeds 99 per cent (though, for some products, CME’s coverage was lower), while FINet has the lowest at 97 per cent.¹⁷

CCPs can use a combination of posted margins and clearing funds to cover single and multiple defaults. Generally, CCPs plan to cover the largest single defaults through the defaulter’s margins and clearing fund contributions (and, potentially, CCP first lien equity). Non-defaulting members’ clearing fund contributions appear to be unaffected. However, situations with multiple defaults and contagion could tap the additional resources.

Both North American CCPs, CME and FINet, utilize “double liability” (if losses exceed all resources in the default waterfall up to and including the clearing fund, the CCP is given the right to call a predetermined amount of additional capital from CMs) for clearing fund contributions. In times of default, even if a surviving CM wants to close its CCP membership, it is still responsible for this additional liability. This double liability ranges from 275 per cent of initial clearing fund contributions for CME to 500 per cent of initial collateral for FINet.

¹⁷ Declared coverage ratios are dependent on the CCP’s own internal assumptions and risk models. Therefore, a lower coverage ratio based on more conservative risk-model assumptions may represent a safer risk position than a comparably higher coverage ratio based on more aggressive underlying assumptions.

Trade-Offs and Analysis

In their goal to cover defaults, CCPs are faced with a variety of alternatives. By adjusting the relative contribution of posted margins, default fund contributions and double liability, CCPs can create similar risk-management outcomes. Some of the implications of these choices are discussed in greater depth below.

First, CCPs must set risk-management policies along the continuum of options between pure defaulter-pay and non-defaulter-pay frameworks. Defaulter-pay models increase margins and coverage ratios, thus obviating the need for a substantive default fund. Conversely, a non-defaulter-pay model insures against losses through the larger clearing fund, thus lowering the requirement for posted margins (Haene and Sturm 2009).

Defaulter-pay systems may decrease moral hazard, since a CM is responsible for a larger proportion of its losses, and thus will face an increased incentive for prudence. Conversely, non-defaulter-pay systems pool the risk like an insurance fund, and may give CMs the incentive to take more risk, much as property insurance creates the perverse incentive to be less vigilant about locking your front door (Haene and Sturm 2009; IMF 2010).

Defaulter-pay systems may decrease the CCP's value proposition, by precluding its counterparty insurance function. However, increasing the relative importance of default fund contributions (and decreasing initial margin coverage) increases the insurance benefits of the CCP, and thus its value proposition.

Non-defaulter-pay systems further increase the CM's monitoring incentive. When more of a CM's capital is tied to the default fund, the CM will face an increasing incentive to monitor the CCP's risk-management procedures and membership criteria. Conversely, in defaulter-pay systems, CMs post margins only to cover their own losses; therefore, their incentive is merely to prevent their own default (IMF 2010).

Second, using clearing fund double liability creates an inherent trade-off. In times of CM default, the existence of double liability provides an additional layer of protection for the CCP. Moreover, it increases a CM's monitoring incentive to ensure appropriate CCP risk management. However, lower levels of double liability decrease the CM's downside, and thus increase the attractiveness of membership. Lastly, decreasing double liability increases the CCP's own capital exposure and thus aligns its interests toward risk management.

Benchmarks

CCPs do not choose between a pure defaulter-pay or a non-defaulter-pay philosophy (Haene and Sturm 2009). Rather, they attempt to strike a balance between some of the aforementioned trade-offs. However, a few benchmarks can be derived from the above analysis.

First, high coverage ratios should be considered to match those of international comparables.

Second, in extreme situations, clearing fund double liability of 100 per cent or higher can be utilized. However, double liability, and the loss waterfall more generally, should be viewed holistically, rather than on a line-by-line basis. For example, higher double liability requirements make more sense when there is a lower initial clearing fund contribution (e.g., FINet).

3.4 Loss allocation to non-defaulters

Trends (Exhibit 4: Risk Management – Loss Allocation to Non-Defaulters)

When default losses exceed defaulter contributions (and CCP first lien equity, if applicable), CCPs employ varying loss-allocation formulas. FINet allocates these losses effectively based on the defaulter's recent trading with particular non-defaulting CMs. On the other hand, the three international CCPs share the defaulter's loss across the entire default fund based on the CM's proportional contributions. An interesting nuance is CME's general adherence to this latter philosophy, while allocating losses depending on which product type (traditional versus CDS) creates the default.¹⁸

Trade-Offs and Analysis

There is an inherent trade-off between "fairer" default fund loss allocation based on trading volumes and increased counterparty risk mitigation. Under FINet's system, members are never completely free of CM counterparty risk, since any default could still end up disproportionately affecting them. CMs may thus be motivated to engage in bilateral monitoring of other CMs. However, counterparty monitoring is a key CCP benefit, and an activity for which it faces economies of scale. Therefore, excessive bilateral monitoring creates an inefficient replication of activities that a CCP may most efficiently be positioned to undertake.

The international CCPs utilize an allocation more closely resembling an insurance fund, which effectively spreads the counterparty risk uniformly. Should the clearing fund be utilized, losses are proportional to the initial contributions. Overall, though proportional allocation may demonstrate less "fairness," it increases a CM's motivation to concentrate on monitoring the CCP and its risk practices, rather than trading partners.

CME's utilization of a balanced solution may provide a middle ground. It allocates CDS default losses predominantly to a CDS-specific clearing fund (and conversely allocates traditional product losses to its clearing fund). Vastly different products, such as CDS and government debt, involve starkly different risk profiles, and may be traded by different groups of CMs. Therefore, CME's clearing fund separation may be "fairer," since loss allocation demonstrates a higher correlation to the CM's actual trading activity.

Benchmarks

CCPs should consider allocating losses based on proportional clearing fund contributions, rather than relative trading with the particular defaulter. Depending on the breadth of financial instruments the CCP

¹⁸ LCH SwapClear (LCH 2009b) uses a similar methodology by allocating losses based on participation by currency (e.g., losses in euros are first shared among euro market participants).

clears, the risk profiles of the products and the relative trading activity of CMs, different product-based clearing funds can be implemented.

3.5 CCP resources in the pecking order

Trends (Exhibit 5: Risk Management – CCP Resources in Loss Waterfall)

The comparable CCPs differed in their inclusion of CCP first lien equity in the loss waterfall and the availability of last-resort financing in their capital structure.

All of the international CCPs included some amount of CCP equity in the loss waterfall ahead of the non-defaulter's clearing fund contributions, generally in the range of 4.5 per cent (Eurex) to 14.9 per cent (LCH)¹⁹ of equity. The resulting loss waterfall was typically: (i) the defaulter's margins, (ii) the defaulter's clearing fund contributions, (iii) CCP first lien equity, (iv) the non-defaulter's clearing fund contributions, and (v) additional resources including the remainder of CCP equity, parental guarantees or insurance. FINet was the only sampled CCP that did not include a provision for first lien equity.

CCPs also differed in their availability of last-resort resources. In their simplest form, CCPs could provision the use of their equity balance (after the first lien disbursement; e.g., LCH). Alternatively, CCPs could maintain a parental guarantee (e.g., Eurex) or insurance coverage (e.g., LCH pre-2008).

Trade-Offs and Analysis

Changing the CCP loss waterfall has considerable risk-management and incentive implications.

In the loss waterfall, when the defaulter's margins and clearing fund contributions have been exhausted, losses can either be allocated to a defined tranche of CCP first lien equity or applied directly to the non-defaulter's clearing fund contributions. The existence of CCP first lien equity affects risk-management incentives. On the one hand, it aligns CCP incentives toward risk management. This is particularly important when the CCP is owned by an exchange or business group (e.g., non-member owned) with competing interests (e.g., increased volume) (IMF 2010). However, as the first lien equity buffer increases, the risk position of non-defaulting CMs improves, thereby decreasing their monitoring incentive.

Second, the existence of last-resort resources presents both advantages and disadvantages. Insurance or parental guarantees theoretically decrease systemic risk, since additional capital is available in times of default. Moreover, insurance companies or corporate parents facing a large potential liability may increase their monitoring. Furthermore, parental guarantees align interests toward risk management. The downside to increased last-resort resources is higher costs, directly translating to either lower CCP profits (thus decreasing the incentive for CCPs to provide this service) or higher member fees (thus lowering incentives for CMs to join).

¹⁹ Obtained by dividing CCP first lien equity by total equity. Data sourced from relevant annual reports. Segregated CME Clearing subsidiary equity was unavailable.

Though insurance coverage theoretically sounds appealing, it may not be necessary. LCH cancelled their insurance coverage in 2008 (£100m per single member default, up to £200m) with no ensuing effect on its Standard & Poor's ratings.²⁰

Potentially, the absence of first lien equity at FINet can be explained by its smaller size relative to comparables, its existence as a subsystem within CDS, and the inherent optionality around its central clearing solution (CMs elect to settle through CDS, or have trades novated through FINet).

Benchmarks

CCPs should maintain first lien equity capital ahead of non-defaulting members' contributions. Second, as a last recourse, and where applicable, CCPs should have defined access to the resources of the parent.

3.6 Short-term liquidity

Trends (Exhibit 6: Risk Management – Short-Term Liquidity)

In times of CM default, CCPs must meet a defaulter's cash obligations until it can transfer, hedge or close them. To mitigate this liquidity risk, CCPs generally maintain short-term credit facilities. However, the sampled CCPs varied along a few dimensions.

Universally, when disclosed, the sampled CCPs maintained some form of short-term liquidity line. Relative to the initial equity capital tranche, it exceeds 100 per cent of first lien capital (e.g., 500 per cent for LCH).²¹ Unfortunately, the internal methodology by which the sampled CCPs determined the appropriate liquidity line size was not disclosed. Generally, they are sourced from multiple financial institutions (at least two), and often from an international consortium.

Short-term liquidity lines are sometimes denominated in multiple currencies. However, this is largely tied to the types of financial instruments that the CCP clears. For instance, LCH clears multiple currency products and thus requires a multi-currency line.

Finally, in times of default, CCPs' official procedures accord them some flexibility regarding the timing of capital distributions and collateral liquidation.

Trade-Offs and Analysis

Decisions surrounding short-term liquidity involve certain trade-offs.

First, an inherent trade-off exists when considering the type and quantity of short-term liquidity. Access to larger liquidity lines in multiple currencies decreases CCP risk and increases safety. However, increased access also raises costs. This logically translates to either higher fees or lower profitability.

²⁰ See Standard & Poor's (2010) for a more detailed discussion.

²¹ Obtained by dividing the liquidity line by first lien capital, resulting in 600 per cent for CME and 500 per cent for Eurex.

Second, there are many considerations around liquidity line sourcing. Having multiple suppliers decreases counterparty risk through diversification. Nevertheless, as above, it also increases costs, since it is simpler to deal with one institution. While having the liquidity line provided by a non-CM provides more conservative risk management,²² this objective is often difficult to achieve, since many of the larger financial institutions capable of offering the product are themselves CMs (IMF 2010). However, the concern over having a single non-CM liquidity provider is partially mitigated should it be a central bank, or a financial institution with a government guarantee (explicit or even potentially implicit through “too big to fail” status). By extension, there exists a further trade-off when considering the availability of last-resort lending from the central bank. While it certainly improves the CCP’s risk position, it may jointly decrease its incentive to get a sufficiently large credit line, alongside decreasing the monitoring incentive of the private credit line provider.

Third, there is a trade-off between the types of collateral accepted and the size of the liquidity line. If the only type of collateral accepted by the CCP were cash and highly liquid government securities (e.g., facing $T+0$), a smaller liquidity line would be necessary. However, when a CCP accepts less-liquid assets as collateral, it offers CMs flexibility but necessitates a larger liquidity facility.

Fourth, there is a trade-off between liquidity lines and flexible procedures in times of default. Increased flexibility accords CCPs more time to liquidate collateral, thereby decreasing liquidity needs. Conversely, should immediate liquidity be necessary, CCPs may require a larger liquidity facility.

Finally, there is an endemic trade-off between flexibility in default procedures and the smooth functioning of the markets. As previously discussed, increased flexibility decreases risk. However, by allowing the CCP to postpone cash payments and securities deliveries, for example, the default flexibility may create a market disruption. Through its self-preservation, the CCP could potentially exacerbate systemic instability.

Benchmarks

Considering the inherent trade-offs surrounding liquidity lines and default procedures, CCPs have provided certain benchmarks, discussed below.

CCPs should have access to sufficient short-term liquidity, though the target clearly depends on a variety of factors including the product mix and acceptable collateral. Multiple currency access becomes necessary only as CCPs increasingly engage in international clearing (IMF 2010). The liquidity lines should be sourced from more than one bank, and ideally a consortium.

CCPs should also be accorded some flexibility in times of default. As will be discussed in the following section, defaults do occur, and can be calamitous.

²² Were a liquidity line providing CM to default, it would concurrently be unable to meet margin obligations and provide liquidity to the CCP. Therefore, at the exact moment that the liquidity line is needed, it would be unavailable.

3.7 Default history

Trends (Exhibit 7: Risk Management – Default History)

The uncomfortable reality that defaults can and do happen must imperatively remain in the collective memory of all CCPs. Over the course of history, three independent CCPs have gone bankrupt: Paris in 1973,²³ Kuala Lumpur in 1983²⁴ and Hong Kong in 1987²⁵ (IMF 2010). Of the four CCPs sampled in this paper, all three international CCPs faced significant CM defaults, including Lehman Brothers (CME, Eurex and LCH); Drexel Burnham Lambert (CME); Bear Stearns (CME); LTCM (CME); and Barings Bank (CME and LCH). In all these international CCP comparables, defaults have been handled safely, with no contagion and without resorting to non-defaulter clearing fund contributions. FINet has faced no member defaults.

Benchmarks

CMs can and do default; without adequate risk management, these defaults can and do lead to CCP failure. Therefore, a long-term focus should be maintained, even in boom times while optimism is high. When modelling, and defining the risk-mitigation framework, CCPs should consider a variety of default and contagion scenarios.

4 Inter-CCP Links

There are several types of links that a CCP may establish with one or more other CCPs. In the wake of the current internationalization of financial markets, inter-CCP links offer economies of scale and scope through cross-market clearing and netting, which effectively reduces outstanding notional positions and collateral costs. When examining CCP-to-CCP links, one must consider the level of integration, the location and method of holding collateral, and the global evolution of standards.

Trends (Exhibit 8: Inter-CCP Links)

First, different types of CCP links reflect different levels of integration, in turn translating into different implications for systemic risk management. Cross-margining, where clearers connect to each CCP but margin calculations take into account the net position across CCPs, represents a more limited form of inter-CCP link than do either peer-to-peer interoperability or participant links, where one CCP becomes a clearing member of another.^{26,27}

Second, different locations and methods of holding collateral are possible. For instance, in the case of a cross-border link, margin can be held either onshore or offshore. It can also be held jointly (e.g., under their cross-margining agreement, CME and the Options Clearing Corporation maintain a joint first lien on

²³ Failed relating to unmet margin calls after a decrease in sugar prices on the futures exchange.

²⁴ Failed relating to unmet margin calls after a decrease in palm oil futures prices on the commodity exchange.

²⁵ Failed relating to unmet margin calls on equity futures due to the October 1987 “Black Monday.”

²⁶ See CPSS-IOSCO (2011) for a description of the different types of CCP-to-CCP links.

²⁷ Other ways of providing non-CMs with access to a CCP are also possible. For example, although no peer-to-peer or participant link exists between FINet and any other CCP, CDS members (all FINet CMs are, by necessity, CDS members) can be sponsored to other organizations. See CDS (September 2010) for further details.

a performance bond; margin coverage is shared to cover each CCP's loss equally), or held in separate "pots" subject to a loss-repayment scheme (e.g., in the case of the cross-margining agreement between CME and the Fixed Income Clearing Corporation).

Overall, policies for, and risk management of, CCP links are still in their infancy. For example, there are only two peer-to-peer linking arrangements currently in existence: one between LCH.Clearnet Ltd. and SIX x-clear (for cash equities), and another between LCH.Clearnet SA and CC&G (for Italian government bonds).^{28,29}

Trade-Offs and Analysis

Inter-CCP links are a relatively new phenomenon, and CCPs must consider both their advantages and disadvantages.

First, while links potentially increase netting benefits and provide CMs with access to a broader range of counterparties and products, they can also be costly (in terms of the increased collateral required to collateralize the link), and introduce new legal and operational risks to the clearing system that must be managed. It is important to keep in mind that different types of links yield different levels of trade-offs (IMF 2010; Ripatti 2004).

Second, there is a trade-off between links and horizontal integration. Inter-CCP links decrease the need for horizontal integration, and concurrently should offer more effective domestic oversight of a locally-based linked CCP. Although links provide CCPs with some of the advantages of economies of scale and scope, complete horizontal integration likely yields stronger netting benefits, centralized risk management and increased back-office synergies.³⁰

Links may represent a cautious first step toward horizontal integration. Linkages create the opportunity for CCPs to familiarize themselves with each other, and for regulators to increase their comfort level with increasing CCP internationalization. Jointly, these effects may facilitate an eventual merger.

Third, there is a trade-off around the optimal level of competition. Links and horizontal integration will increase global netting benefits, and, given inherent economies of scale and scope, decrease costs. Additionally, in times of CM defaults, interoperability and horizontal integration minimize the number of players liquidating defaulting positions. For example, the Lehman failure affected CME, Eurex and LCH: potentially, they all concurrently needed to liquidate collateral. Therefore, interoperability may decrease the number of affected parties. Furthermore, links and horizontal integration effectively increase the systemic centrality of a CCP, which decreases the probability of individual financial market disruption but increases the systemic risk associated with a potential CCP failure. Furthermore, decreased

²⁸ CC&G is Cassa di Compensazione e Garanzia S.p.A., an Italian CCP.

²⁹ There are currently no links between LCH.Clearnet Group's two subsidiaries: LCH.Clearnet Ltd. (based in the United Kingdom and discussed in detail in this paper) and LCH.Clearnet SA.

³⁰ As in Ripatti (2004), historical horizontal CCP mergers yield technical efficiency alongside netting benefits of cross-border clearing (the latter being possible through interoperability).

competition (between CCPs) may stymie innovation and increase industry costs through oligopolistic pricing.

Benchmarks

Inter-CCP links are in their infancy. Global CCP benchmarks and international standards are quickly evolving. CCPs and regulators should have a full understanding of the complexity of linking arrangements before choosing this course. But, at the same time, they should recognize that links may support better oversight and a more robust market structure.

5 Governance

A CCP's governance structure strongly affects its ability and incentives to ensure appropriate risk management. Two specific committees examined in this paper are the Board of Directors and the risk committee, with a focus on their structure, composition, control and incentives.

5.1 Board of Directors

Trends (Exhibit 9: Governance – Board of Directors)

Standards for CCP governance continue to evolve. The sampled CCPs vary greatly based on a number of factors including ownership structure, for-profit status, CCP Board separation and independent Board representation.

CCPs are either for-profit or non-profit. They can also be either horizontally integrated clearing conglomerates (e.g., LCH.Clearnet Group Ltd.) or vertically integrated businesses including exchanges or settlement (e.g., CME Group and Eurex). Based on the limited sample, non-profit CCPs are generally member-owned and smaller (e.g., FINet).

CCPs do not necessarily have their own separate Boards. This generally varies by size and the relative independence of the CCP. For instance, FINet is a smaller system within CDS, and does not have its own Board or staff. Conversely, both European CCPs, Eurex and LCH, have separate CCP Boards. CME Clearing is the exception: it has no dedicated CCP Board.

When CCPs have a separate Board, they often employ multiple independent directors (four for both LCH and Eurex, representing 33 per cent of a total 12-member Board). However, these independent directors are in the minority and do not exert direct control.

Trade-Offs and Analysis

Board-level governance involves multiple trade-offs concerning CCP Board separation, integration, independent representation, and control.

As Ripatti (2004) discusses, CCP Boards create a principal-agent problem between the Board, management and users. For instance, vertically integrated CCPs (e.g., the organization owns the

exchange) clearly demonstrate this inherent trade-off. A separate CCP Board may encourage self-interested “independent” CCP-level decisions that favour risk management ahead of the parent’s interests (e.g., profitability) (IMF 2010). Conversely, a non-separate CCP Board allows more integration and parental control, potentially facilitating faster decision making and organizational responsiveness.

Additionally, there is a trade-off between risk management and operational integration. For example, a separate Board promotes risk management but leads to lower vertical integration, and thus lower synergies. However, the academic literature suggests that horizontally integrated CCPs, relative to vertically integrated companies, yield greater efficiency gains (Koepl and Monnet 2004). Therefore, mandating separate Boards may provide an incentive for horizontal rather than vertical integration, since this requirement is less onerous for the former (a separate CCP Board is, de facto, the horizontal organization’s Board), which concurrently would increase efficiency.

Further, there is a trade-off in the decision to include independent Board representation. Increased independence may raise the risk-management focus and bridge external knowledge. However, decreased independence may yield more Board-level expertise (assuming that there are few external CCP experts).

Moreover, even without overt control through a 50 per cent majority, independent Board members yield considerable influence. Many CCPs (e.g., Eurex) face joint ownership: the block of independent directors could sway the balance of power between conflicting owner groups. Consequently, when considering independent Board representations, a potential loss of control must be considered.

Different ownership structures may help explain the different observed outcomes. For instance, a member-owned system may not require a separate CCP Board (e.g., FINet). Theoretically, members have their own best interests at heart, and thus will supervise the group as a whole to ensure proper CCP risk management. However, when the CCP is owned by a for-profit entity (e.g., Eurex³¹), its interests (such as risk management) may conflict with those of the organization at large (profitability).³² Therefore, maintaining a separate CCP Board with independent representation becomes increasingly important.

Benchmarks

Benchmarks depend strongly on a variety of factors including profit mandate, ownership concentration and organizational structure. However, two key lessons arise. First, if the CCP is part of a vertically integrated conglomerate, it should have a separate Board with independent directors (IMF 2010). Second, one profit motive and ownership structure is not necessarily superior to another as long as incentives are properly aligned.

³¹ As of 2009, LCH is majority-user owned, with dispersed ownership. However, pursuant to the original merger between the London Clearing House Ltd. and the Banque Centrale de Compensation SA when the Board composition was presumably set up, ownership was more concentrated, with exchanges holding over 45 per cent.

³² See IMF (2010) for a more detailed discussion.

5.2 Risk committee

Trends (Exhibit 10: Governance – Risk Committee)

As with Board-level governance, CCP risk committee governance varies greatly among the sampled CCPs, based on a number of factors including risk committee independence, composition and role within the organization.

Both CME and LCH have their own risk committees. The risk functions of FINet and Eurex, however, are incorporated into the vertically integrated organization.

Risk committees can either be independent and report directly to the Board, or be non-independent and run by management. When risk committees exist at the CCP level, they tend to report to the CCP Board (e.g., CME and LCH). Conversely, Eurex Clearing, whose risk function is integrated with the group, has risk reports delivered to CCP management.

Independent risk committees tend to have Board representation. For example, both CME's and LCH's risk committees are chaired by Board members. However, CM representation is not uniformly strong. For example, Eurex's group risk committee has no formal CM representation. CME, by contrast, maintains at least five CM representatives, and LCH allows CMs to participate as consultants.

Trade-Offs and Analysis

When examining risk committee governance, a variety of trade-offs must be considered.

First, there is a trade-off between having a CCP risk committee and a group-level risk committee. A CCP-level risk committee may yield a stronger organizational focus on CCP-specific risk management. However, maintaining multiple risk committees across an organization increases costs. Furthermore, vertically integrated risk committees may support more holistic risk management, approaching issues from an organizational point of view, rather than solely a CCP-level perspective.

Second, there exists a trade-off between an independent risk committee and a management-run committee. The former likely demonstrates stronger risk-mitigation incentives; management may have different motivations, such as profits and volume. Conversely, the latter may be more organizationally efficient, placing those who presumably know most about CCP risk in charge (i.e., the CCP's own risk managers).

Third, there is a trade-off when considering CM representation on the risk committee. Giving CMs a voice promotes inclusivity and may provide additional industry expertise. However, CMs may have conflicting interests. For instance, they may have an incentive to decrease risk management or push additional risk to the CCP; e.g., by pushing for lower margin and default fund requirements, they decrease their total membership costs. This is, of course, contrary to the CCP's broader mandate to manage systemic risk. Additionally, allowing a wider risk committee membership, with conflicting interests, may slow decision making.

As was noted with the Board of Directors (section 5.1), different ownership structures may translate into different governance outcomes. A non-profit user-owned model (e.g., FINet) may not require an independent risk committee, while a vertically integrated for-profit organization may necessitate one (e.g., CME).

Certainly, no one-size-fits-all solution exists for risk committee governance. Eurex Clearing provides risk function independence through outsourcing to Deutsche Börse. Others provide independence through separate committees with direct reporting lines to Board members. As long as incentives are aligned, and risk management remains at the forefront, different solutions can be effective.

Benchmarks

Though standards vary depending on an organization's structure and profit motive, basic benchmarks can be identified. If the CCP is part of a vertically integrated conglomerate, it should have its own separate risk committee. The committee should be independent, with Board representatives, a direct reporting line to the larger Board and responsibility for key risk-management oversight. Some non-voting CM representation can provide additional expertise. These conclusions are consistent with the IMF's recent study on increasing CCP safety (IMF 2010).

6 Operational Risk Management

Operational risk management considers the CCP's ability to manage operational problems and crises in the course of normal business activities (e.g., a surge in demand) or exceptional events (e.g., an earthquake, strike, fire). This section discusses backup arrangements and backup testing specifically.

6.1 Backup arrangements

Trends (Exhibit 11: Operational Risk Management – Backup Plans)

CCPs have made different procedural choices when approaching business-continuity management and operational risk management. Backup arrangements include data backup facilities, operational backup centres, structural backups and recovery-time objectives (RTOs).

Though public information is sparse, all sampled CCPs maintain at least one backup site, and some have multiple undisclosed locations. Regarding operational centres specifically, CCPs tend to have multiple locations. For instance, CDS, FINet's parent, runs its operations out of two main centres alongside its backup facilities.

CCPs consistently employ structural backup arrangements for their facilities. These include backup generators and redundant telecom connectivity.

RTOs (though often undisclosed) are consistently defined and often involve aggressive process-reinstatement targets. For example, LCH plans for "phase 1" immediate recovery within two hours of an incident.

Trade-Offs and Analysis

Business-continuity management is an important component of risk management. Therefore, procedural decisions are imperative and involve considerable trade-offs.

First, there is a trade-off relating to data backup location. Placing the location farther away decreases the risk that whatever event caused the primary-location failure will also affect the backup facility (e.g., an earthquake hitting Toronto is more likely to affect neighbouring cities like Mississauga than those in completely different geographical regions, such as Vancouver). However, given data travel time, seamless data replication becomes increasingly difficult as distances increase between centres.

Second, there is an inherent trade-off when considering the number of backup sites. On the one hand, redundant backup sites significantly decrease risk: for a critical event to interrupt CCP activities, all backup facilities must be hit simultaneously. However, building, maintaining and staffing multiple backup sites greatly increases costs, which, as previously discussed, decreases CCP profits (thus decreasing the incentive to provide the service) or increases CM fees (decreasing the incentive to join).

Benchmarks

A CCP should have at least one data backup site. If the secondary site is relatively near the CCP primary location, consider a tertiary site farther away to decrease the risk related to an event impacting both the primary and secondary sites. Similarly, a CCP should maintain multiple operational sites.

CCP facilities and backup sites should themselves have structural backup arrangements (e.g., generators and telecom connectivity).

Finally, RTOs should be defined and aggressive (e.g., requiring less than two hours for the recovery of key processes).

6.2 Backup testing

Trends (Exhibit 12: Operational Risk Management – Backup Testing)

The sampled CCPs vary in terms of testing frequency, review of procedures for business-continuity management and usage of the backup facility.

Generally, the CCPs conduct backup testing at least annually (e.g., LCH), and up to twice annually (e.g., FINet). The procedures for business-continuity management are often reviewed multiple times per year, usually quarterly.

CCP backup facilities are important and they are utilized. For example, FINet has used theirs three times: during the SARS crisis in 2003, the Toronto power blackout in 2003 and the G-20 summit in 2010.

Trade-Offs and Analysis

Business-continuity management faces two key trade-offs.

First, there is a trade-off in the frequency of backup testing. Increased testing translates into stronger preparedness and the ability to anticipate potential problems. However, it increases costs and potentially interrupts day-to-day operations.

Second, there is a trade-off when considering the frequency with which procedures for business-continuity management should be reviewed. Superficially, more-frequent review seems favourable. However, a too-frequent review may dilute the comprehensive nature of the analysis, the quantity of actual out-of-the-box thinking and the intensity of fundamental policy changes.

Benchmarks

Two benchmarks are derived from the sampled CCPs: a CCP should conduct annual backup testing and, quarterly, review of its procedures for business-continuity management.

7 Potential Areas for Further CCP Analysis

This paper has provided an analysis of CCP industry best practices for some key practical issues of risk management, links, governance and business-continuity management. Further analysis could be considered in a number of different areas.

First, different categories of practical issues could be examined, such as the implications and trade-offs of regulatory risk.

Second, different specific practical issues could be analyzed. For example, future analysis could consider settlement risk in more depth. Furthermore, the discussion of CCP links in this paper dealt primarily with horizontal-level integration between CCPs. However, CCPs also engage in other linkages, with other key providers, such as securities depositories; an analysis of the considerable risk-management implications of such agreements would be valuable. Moreover, the discussion herein of operational risk focused mainly on business continuity. An examination of other issues such as legal risk and model risk would provide additional insight.

Third, a different level of detail could be analyzed. The objective in this paper was to provide broad high-level conclusions of global CCP practices, trade-offs and benchmarks. Future analysis could address specific product-by-product nuances within CCP policies (e.g., the slight differences in collateral acceptability by product class).

Fourth, a larger sample of international CCPs could provide a broader perspective of the international marketplace. For instance, the following CCPs could be considered: ICE Trust U.S., ICE Clear Europe or the Options Clearing Corporation.

Fifth, given the evolving nature of CCPs, this analysis should be reviewed periodically.

Sixth, this paper maintained a strong overall focus on risk management. A recurring trade-off exists between risk management and efficiency. Future analysis could delve deeper into specific questions of efficiency.

Finally, this paper was based on public information, which is often sparse and generally lacking in contextual detail. Interviews with CCP staff and regulators, alongside internal documentation, would provide a deeper, clearer understanding of the decision-making process behind CCPs.

8 Conclusion

Globally, CCPs have been purported to provide a solution to systemic risk for a variety of financial markets, ranging from repos and options to swaps. However, internationally accepted standards and the academic literature have left unanswered many practical questions related to the design of CCPs. This paper has analyzed international benchmarks for a certain set of issues. Specifically, four CCPs – FINet, CME Clearing, Eurex Clearing and LCH.Clearnet – were examined in terms of risk management, interoperability, governance and operational risk.

Four major themes have emerged from this analysis: the constant push-pull between risk management and profitability, the inherent trade-off between CCP flexibility and transparency, the necessity of adapting policies to the local environment, and the requirement to view CCP trade-offs and benchmarks holistically.

First, the most recurring trade-off has been between increased risk management and CCP profitability (either by changing CCP attractiveness to CMs or by directly changing CCP operational costs). For instance, a more conservative acceptable collateral, margin requirements and default fund contributions would decrease CM attractiveness while increasing systemic risk mitigation. Similarly, increased CCP equity in the pecking order, larger short-term liquidity lines and more backup centres would increase risk mitigation while concurrently increasing costs.

Second, there remains a trade-off between providing increased transparency and according the CCP additional flexibility (and thus tools to deal with risk). Two examples include the use of qualitative membership requirements and the availability of flexible default procedures.

Third, CCP policies must reflect the local context, and are not globally uniform. This paper has identified several instances where local conditions demanded adaptation of risk-mitigation policies. For example, the acceptability of international debt as collateral depended on the size of the local government debt market, the breadth of the CCP's coverage and the euro as the home currency. Similarly, the number of currencies offered by the liquidity facility was linked to the types of markets served by individual CCPs.

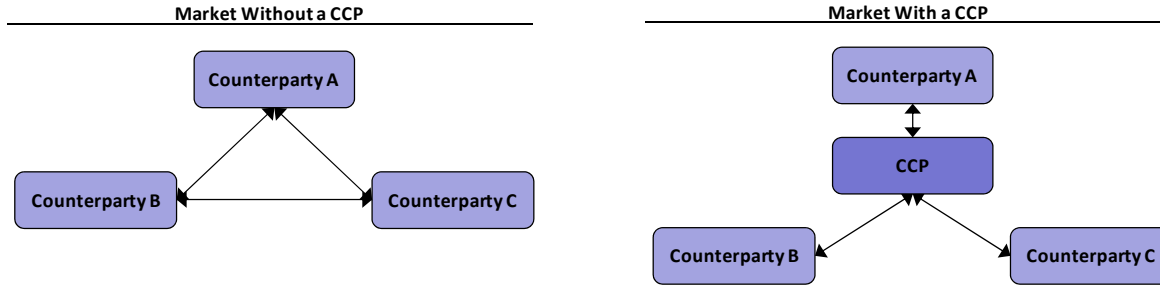
Finally, CCP policies should not be considered individually, but rather holistically. For instance, it would be inappropriate to consider changes in the default fund without considering the particularities of the margin requirements and the pecking order. Similarly, changes in acceptable collateral must be

reviewed in tandem with the short-term liquidity line. Ultimately, a CCP must offer an internally consistent set of policies offering the appropriate balance of risk management and efficiency.

The analysis and above themes have been helpful for the Bank of Canada's understanding of CCPs, specifically in light of CDCC's announcement of a new CCP for repos. Given the present global interest in CCPs, it is hoped that this paper will prove useful for other analyses to come.

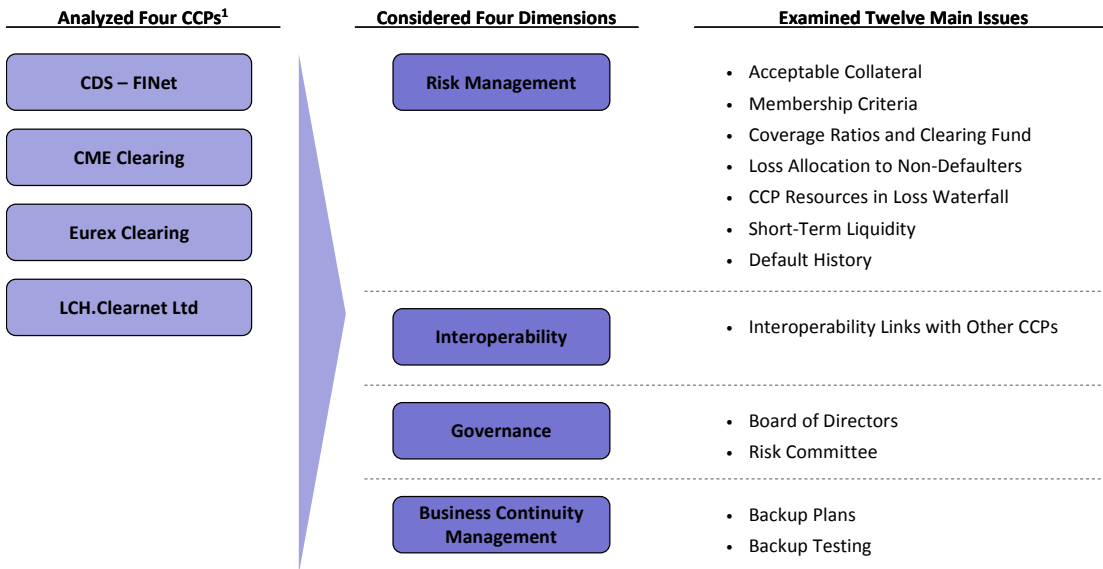
Appendices and Exhibits

Appendix A: CCP in a Market



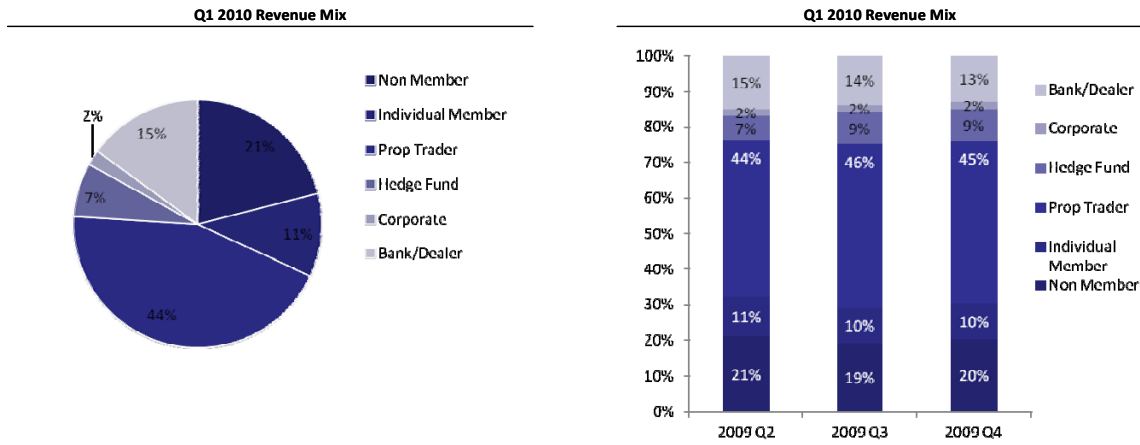
A CCP decreases counterparty risk, “the risk in a bilateral transaction that one party defaults on its obligations to the other” (IMF 2010), by interposing itself between trading partners. It becomes the “buyer to every seller, and seller to every buyer, thereby ensuring settlement even if one of the original trading partners fails to meet its obligations” (Haene and Sturm 2009). Therefore, trading partners face only CCP counterparty risk. Among other benefits, a CCP also decreases systemic risk through multilateral netting (IMF 2010).

Appendix B: Methodology



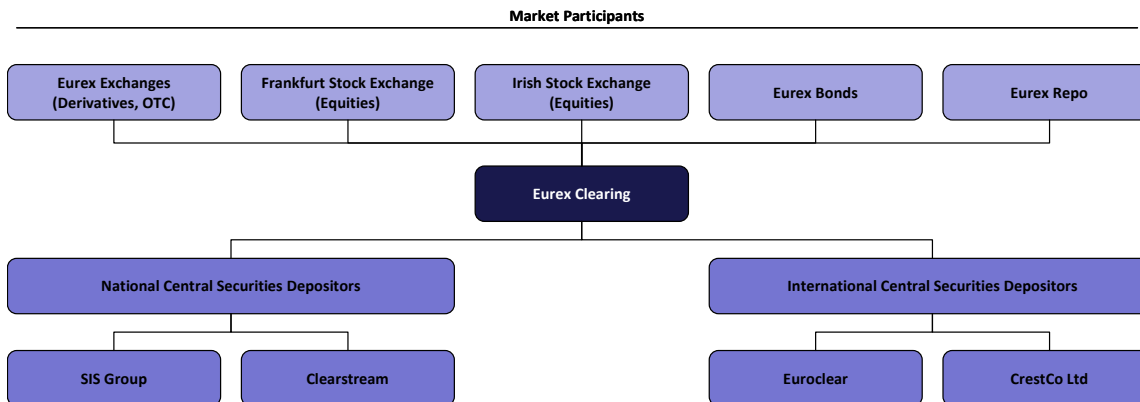
1. Detailed CCP level information available in Appendix A

Appendix C: CME Revenue and Customer Mix



Source:
CME Group Overview, Presented at the William Blair & Company 30th Annual Growth Stock Conference

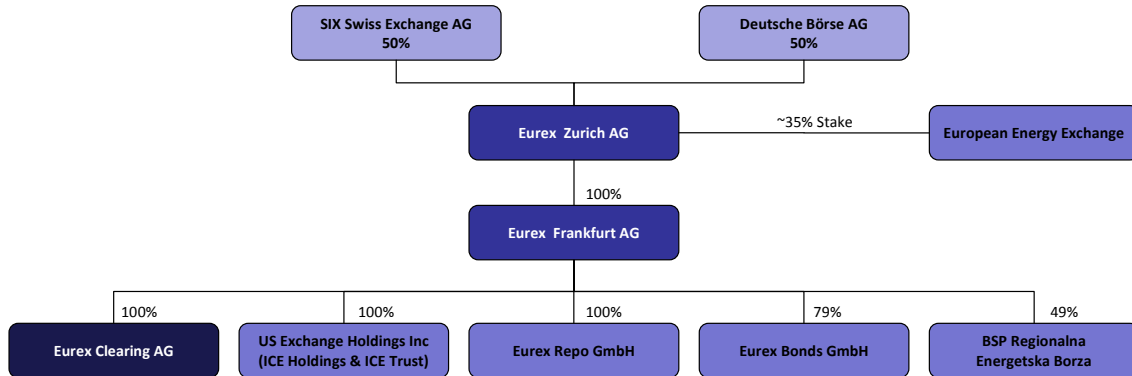
Appendix D: Eurex Clearing Product Mix



Source:
Eurex Clearing "Clear to Trade" October 2008

Appendix E: Eurex Corporate Structure

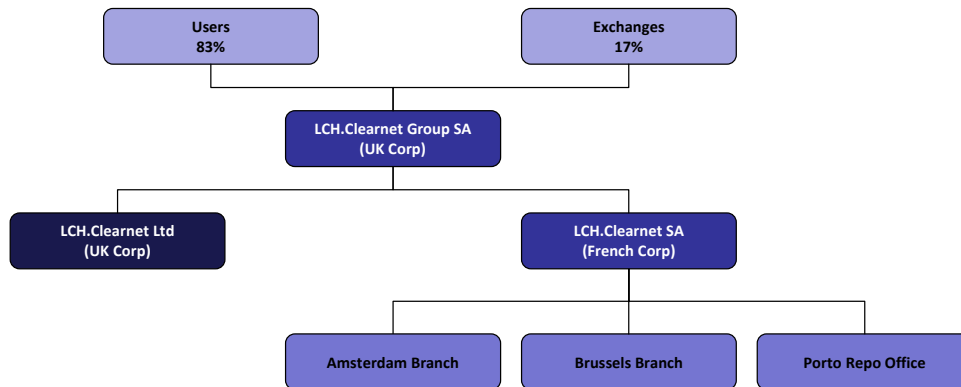
Eurex Clearing's Position in the Corporate Structure



Source:
Eurex Corporate Profile http://www.eurexclearing.com/about/company_profile_en.html

Appendix F: LCH.Clearnet Group SA Structure

LCH.Clearnet Ltd's Position in the Corporate Structure



Source:
LCH.Clearnet Group SA Legal and Regulatory Structure http://www.lchclearnet.com/about_us/corporate_governance/legal_and_regulatory_structure.asp

Exhibit 1: Risk Management – Acceptable Collateral

CDS - FINet	CME Clearing	Eurex Clearing	LCH.Clearnet Ltd
<ul style="list-style-type: none"> Government of Canada and Provincial government T-bills and bonds (1-2.5% haircut depending on maturity) No letters of credit No bankers' acceptances Equities are not accepted for collateral pools and participant funds, but can make up additional ACV specific to a participant: Standard haircut rate of 25% to all new equity issues After initial 20-day period has elapsed, haircut rate is calculated using VAR-based methodology, subject to a minimum haircut rate of 15% in the first year For equities with no price change for a period of 20 or more consecutive days, haircut rate of 75% 	<ul style="list-style-type: none"> Government bills and bonds from Canada, France, Germany, Sweden, U.K., U.S. Treasuries Bonds (3-10% haircut depending on maturity) Letters of credit from approved banks with a US branch No bankers' acceptances S&P 500 stocks are eligible to meet margins if concentration requirements are met (30% haircut) 	<ul style="list-style-type: none"> Euro-denominated government bills and bonds (3.1% min. haircut, except Portugal which is subject to 12% haircut) Bills and bonds from U.S., U.K., Denmark, Norway, Sweden, Australia, Canada, Japan (3.2% min. haircut) No letters of credit or bankers' acceptances Equities from designated indices subject to maximum of 5% free float, 30% concentration (minimum haircut of 50%) 	<ul style="list-style-type: none"> Government bills and bonds (various maturities) from: Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Spain, Sweden, U.K., U.S. (4.25-9.63% market haircut, depending on maturity) No letters of credit (though "Performance Bonds", which are comparable to letters of credit, are accepted with no haircut and face a limit of £50m per issuer or equivalent if different currency) No bankers' acceptances No equities

Sources:

CDS Financial Risk Model ([http://www.cds.ca/cds/clearinghome.nsf/Downloads/-EN-CDSFinancialRiskModel-Version6.0/\\$File/CDS-Financial-Risk-Model_Version+6.0.pdf?OpenElement](http://www.cds.ca/cds/clearinghome.nsf/Downloads/-EN-CDSFinancialRiskModel-Version6.0/$File/CDS-Financial-Risk-Model_Version+6.0.pdf?OpenElement)), CDS Acceptable Collateral (<http://www.cds.ca/documentation/external/see/seeacceptablecollateral.html>), CME Clearing acceptable collateral (<http://www.cmegroup.com/clearing/financial-and-collateral-management/collateral-types-accepted.html>), Eurex Clearing acceptable collateral (http://www.eurexclearing.com/risk/parameters_en.html), LCH Acceptable Collateral (http://www.lchclearnet.com/risk_management/ld/acceptable_collateral.asp)

Exhibit 2: Risk Management – Membership Criteria

CDS - FINet	CME Clearing	Eurex Clearing	LCH.Clearnet Ltd
<ul style="list-style-type: none"> General CDS members are eligible to use FINet upon application to CDS CDS recognizes different types of members: <ul style="list-style-type: none"> Regulated financial institution Foreign institution Government body Bank of Canada CDS requires every participant to: <ul style="list-style-type: none"> Subject themselves to minimum regulation and maintain good standing with the industry SRO Demonstrate basic standards including financial ability, sufficient personnel and operational capabilities to fulfill obligations to CDS 	<ul style="list-style-type: none"> Adjusted net capital must be greater than \$5,000,000; or CFTC/SEC minimums Submit required regulatory documentation and financial statements Financial capital of <ul style="list-style-type: none"> \$50m for commodities and FX OTC products \$300m for other OTC derivative products where no separate margins are established (excl. CDS and other swaps) \$500m for CDS and other OTC products Provide security deposit with CME Clearing Provide parent guarantees (some exemptions) Demonstrate fiscal and moral integrity 	<ul style="list-style-type: none"> EU or Swiss domiciliation Capital requirements vary by membership type for general clearing members: <ul style="list-style-type: none"> Derivatives clearing: €125m Bond clearing : €50 m Repo clearing : €175m Equity clearing : €25m Players can also become direct clearing members (as opposed to general clearing members) with 10% of above requirements Other key criteria: <ul style="list-style-type: none"> Experience Technology requirement (quite expensive & prohibitive) Membership limited to: <ul style="list-style-type: none"> Credit institutions like banks Bundesbank 	<ul style="list-style-type: none"> RepoClear Dealer applicant requirements include: <ul style="list-style-type: none"> Minimum net capital of €100m Authorized and supervised as either a credit institution or an investment firm by the competent authorities to standards equivalent to EU Other general CM standards include: <ul style="list-style-type: none"> Rating exceeding BBB (or equivalent) by Moody's, S&P or Fitch Parental guarantee Maintenance of back-office with sufficient safeguards and IT readiness

Sources:

Fin Risk Mgmt in CDS's Settlement Services (pg 9), CME Clearing membership criteria (<http://www.cmegroup.com/company/membership/types-of-membership.html?show=Clearing>), http://www.cmegroup.com/company/membership/files/CME_OTC_Clearing_Membership_Summary.pdf, Eurex Clearing Brochure (http://www.eurexclearing.com/download/documents/publications/clearingbrochure_final_en.pdf), LCH.Clearnet Ltd membership criteria (http://www.lchclearnet.com/Images/Section%201_tcm6-43738.pdf)

Exhibit 3: Risk Management – Coverage Ratios and Clearing Fund

CDS - FINet	CME Clearing	Eurex Clearing	LCH.Clearnet Ltd
<ul style="list-style-type: none"> 97% coverage In case defaulter collateral is insufficient to cover losses, residual loss is allocated to surviving FINet participants 500% 'double-liability' should a clearing member want to exit in times of loss allocation 	<ul style="list-style-type: none"> Various methods utilized to cover at least 95% to 99% over varying coverage time-frames Clearing fund minimum of US\$500,000 or results of risk formula Clearing fund calculations are recalculated quarterly Financial safeguards are generally designed to cover two largest defaults across all asset classes; recent analysis suggest CME has sufficient coverage for the largest three defaults CME can call additional clearing fund contributions up to 275% of initial contribution in case of member default 	<ul style="list-style-type: none"> Coverage goal of 99% (using a 1-day close-out period and 750-day sample period) Clearing fund minimum of €5m for GCMs or € 1m for DCMs (though in practice represents 2% of average total margin requirement) Clearing fund contributions are recalculated quarterly Multiple defaults are modelled and only under the most extreme scenarios are clearing fund contributions affected No double-liability 	<ul style="list-style-type: none"> Coverage set to 99.7% Clearing fund minimum depending on product <ul style="list-style-type: none"> Repos and equity: 10% initial margin with £1m minimum Swap: 10% initial margin with £2m minimum Derivatives: 50% based on volume; 50% based on initial margin relative to other members with £100k minimum Clearing fund modelled to cover the largest exposure, or the combined losses of the second- and third-largest exposures <ul style="list-style-type: none"> It also includes losses of affiliates and contagion to the five lowest credit scored members No double-liability to clearing fund, though voluntary contributions are permitted

Sources:

Fin Risk Mgmt in CDS's Settlement Services, CME Clearing Financial Safeguards (<http://www.cmegroup.com/clearing/files/financialsafeguards.pdf>), CME Group Inc. Standard & Poor's, July 20, 2010, Eurex Clearing response to CESR / ESCB consultation (http://www.ecb.int/paym/pdf/cons/escb_cesr/Eurex_Clearing.pdf?9c9a4123780a83252373edc7216ac), Eurex Clearing Fund (http://www.eurexclearing.com/markets/fwb/clearing_fund_en.html), Eurex Clearing: CCP Derivatives – Mitigating Counterparty Risk for Institutional Investors (http://www.eurexclearing.com/download/documents/publications/centrally_cleared_derivatives_mar09.pdf), LCH.Clearnet Ltd IOSCO Assessment (http://www.lchclearnet.com/images/2009%20CPSS-IOSCO%20Assessment%20of%20LCH%20Clearnet%20Ltd_tcm6-53977.pdf), LCH Clearing Fund (http://www.lchclearnet.com/images/lch_clearnet%20Ltd%20-%20default%20fund_tcm6-44536.pdf), LCH.Clearnet Group Ltd. Standard & Poor's, August 23, 2010.

Exhibit 4: Risk Management – Loss Allocation to Non-Defaulters

CDS - FINet	CME Clearing	Eurex Clearing	LCH.Clearnet Ltd
<ul style="list-style-type: none"> Losses are allocated to surviving FINet participants based on the proportion to dollar amount of survivor's recent trades with defaulter 	<ul style="list-style-type: none"> Losses are allocated based on proportional contribution to clearing fund Non-defaulters' guarantee fund contributions are assessed by asset class For example: a default in a traditional product (non-CDS): <ul style="list-style-type: none"> Initially 80% non-defaulting clearing members' security deposit for traditional products Next even split between 20% traditional products and 20% for CDS Next remaining 80% for CDS Lastly double-liability (up to 275%) can be implemented 	<ul style="list-style-type: none"> Losses are allocated based on proportional contribution to clearing fund 	<ul style="list-style-type: none"> Losses are allocated based on proportional contribution to clearing fund

Sources:

Fin Risk Mgmt in CDS's Settlement Services, CME Clearing Financial Safeguards (<http://www.cmegroup.com/clearing/files/financialsafeguards.pdf>), CME Group Inc. Standard & Poor's, July 20, 2010, Eurex Clearing Fund (http://www.eurexclearing.com/markets/fwb/clearing_fund_en.html), Eurex Clearing: CCP Derivatives – Mitigating Counterparty Risk for Institutional Investors (http://www.eurexclearing.com/download/documents/publications/centrally_cleared_derivatives_mar09.pdf), LCH.Clearnet Ltd IOSCO Assessment (http://www.lchclearnet.com/images/2009%20CPSS-IOSCO%20Assessment%20of%20LCH%20Clearnet%20Ltd_tcm6-53977.pdf), LCH Clearing Fund (http://www.lchclearnet.com/images/lch_clearnet%20Ltd%20-%20default%20fund_tcm6-44536.pdf), LCH.Clearnet Group Ltd. Standard & Poor's, August 23, 2010.

Exhibit 5: Risk Management – CCP Resources in Loss Waterfall

CDS - FINet	CME Clearing	Eurex Clearing	LCH.Clearnet Ltd
<ul style="list-style-type: none"> Maximum debit caps prevent CDS participants from having unlimited liability CDS participants may have unlimited exposure through the New York link only CDS does not have capital at risk ahead of survivors in the event of a default 	<ul style="list-style-type: none"> Loss waterfall consists of: <ul style="list-style-type: none"> Defaulter's contributions CME capital (target US100m) Non-defaulters' clearing fund contributions (US\$2.0b) Emergency assessments on surviving participants of up to 275% of initial contributions CCP equity (unavailable) 	<ul style="list-style-type: none"> Loss waterfall consists of: <ul style="list-style-type: none"> Defaulter's contributions Eurex reserves (5m approx) Non-defaulters' clearing fund contributions (€1.65b total) Eurex equity (€110m) Parental guarantee (€700m) 	<ul style="list-style-type: none"> Loss waterfall consists of: <ul style="list-style-type: none"> Defaulter's contributions LCH capital (€20m) Non-defaulters' clearing fund contributions (€594 m) (followed by voluntary clearing fund replenishment contributions) Remainder of LCH capital (€209.3m) Pre-2008: £100m/single member default (up to £200m) of insurance cover For SwapClear only, additional undertaking of £50m pounds per member in event of SwapClear default

Sources:

Fin Risk Mgmt in CDS's Settlement Services, CDS Financial Risk Model (http://www.cds.ca/cds/clearinghome.nsf/downloads/BL_CDSRiskModel-Version3.2.15File/CDS+Settlement+Services+Risk+Model+-+Nov+30+-+2006.pdf?OpenElement), CME Clearing Financial Safeguards (<http://www.cmegroup.com/clearing/files/financialsafeguards.pdf>), CME Group Inc. Standard & Poor's, July 20, 2010, Assessment of Eurex vs. IOSCO standards in 2008 (http://www.eurexclearing.com/download/about/iosco_assessment_2008_public.pdf), LCH.Clearnet Ltd IOSCO Assessment (http://www.lchclearnet.com/images/2009%20CPSS-IOSCO%20Assessment%20of%20LCH%20Clearnet%20Ltd_tcm6-53977.pdf), LCH Clearing Fund (http://www.lchclearnet.com/images/lch_clearnet%20itd%20-%20default%20fund_tcm6-44536.pdf), LCH.Clearnet Group Ltd. Standard & Poor's, August 23, 2010, Australian Central Bank: Participation Requirements in Central Counterparties in March 2009 (http://www.rba.gov.au/payments-system/clearing-settlement/review-requirements/tables.html#table_2), Russo, Hart, Schönenberger. "The Evolution of Clearing and Central Counterparty Services for Exchange-Traded Derivatives in the United States and Europe: A Comparison" 2002.

Exhibit 6: Risk Management – Short-Term Liquidity

CDS - FINet	CME Clearing	Eurex Clearing	LCH.Clearnet Ltd
<ul style="list-style-type: none"> C\$90m liquidity line with BMO/Harris (convertible to US\$ at prevailing exchange rate) From this amount, C\$60m has to be collateralized This line covers CDS's potential liquidity needs for Can\$ and US\$ settlement in CDS and for the cross-border service (also US\$) 	<ul style="list-style-type: none"> \$1.0bn from consortium of banks With the approval of the banks, CME Clearing can increase this liquidity line to \$1.5bn Line is fully secured by security deposits of clearing members and performance bond of defaulted clearing member The line has never been utilized 	<ul style="list-style-type: none"> Not disclosed 	<ul style="list-style-type: none"> £100m of uncommitted liquidity line LCH maintains a minimum daily target of £1.15bn in various currencies. It meets this target using a combination of overnight unsecured and tri-party repos

Sources:

Mahmood, N. and D. Stanton. 2009. "Report to the Risk Advisory Committee: Update on New York Link Service and Liquidity Arrangements", CME Clearing Financial Safeguards (<http://www.cmegroup.com/clearing/files/financialsafeguards.pdf>); Eurex Risk Parameters (http://www.eurexclearing.com/risk/parameters_en.html); LCH.Clearnet Ltd IOSCO Assessment (http://www.lchclearnet.com/images/2009%20CPSS-IOSCO%20Assessment%20of%20LCH%20Clearnet%20Ltd_tcm6-53977.pdf).

Exhibit 7: Risk Management – Default History

CDS - FINet	CME Clearing	Eurex Clearing	LCH.Clearnet Ltd
<ul style="list-style-type: none"> There has never been a default in FINet's history 	<ul style="list-style-type: none"> No customer has ever lost funds due to counterparty failure in any situation including: <ul style="list-style-type: none"> 1987 Stock Market Crash Drexel Burnham Lambert Barings LTCM September 11 terrorist attacks Refco LLC Credit Crisis (Bear Stearns, Lehman Brothers, etc.) "In its more than 100-year history, there has never been a failure by a clearing member to meet a performance bond call or its delivery obligations; nor has there been a failure of a clearing member firm resulting in a loss of customer funds." Additionally, CME has never used its liquidity line 	<ul style="list-style-type: none"> Two CM defaults in history: <ul style="list-style-type: none"> Gontard & Metallbank Lehman Brothers International 	<ul style="list-style-type: none"> There have been five CM defaults in history: <ul style="list-style-type: none"> Drexel Burnham Lambert Woodhouse, Drake and Carey Barings Griffin Lehman Brothers There have also been a few close calls: <ul style="list-style-type: none"> Yamaichi International Enron Metals Refco Securities and Refco Overseas

Sources:

CME Group Inc. Standard & Poor's, July 20, 2010; CME Group Overview (<http://www.cmegroup.com/clearing/overview.html>); Eurex Clearing, "CCP Derivatives – Mitigating Counterparty Risk for Institutional Investors" (http://www.eurexclearing.com/download/documents/publications/centrally_cleared_derivatives_mar09.pdf); LCH Default History (http://www.lchclearnet.com/images/5%20lch_clearnet%20default%20history%202010_tcm6-44530.pdf)

Exhibit 8: Inter-CCP Links

CDS - FINet	CME Clearing	Eurex Clearing	LCH.Clearnet Ltd
<ul style="list-style-type: none"> FINet allows no direct CCP interoperability links CDS however, does sponsor CM access to other CCPs <ul style="list-style-type: none"> All FINet CMs are by necessity CM members 	<ul style="list-style-type: none"> Three interoperability links: <ul style="list-style-type: none"> Options Clearing Corporation: Single performance bond created. In times of default, surplus shared 50/50, unless the proportional surplus exceeds one party's loss, in which case the other side will receive the balance LCH.Clearnet Limited: Have established a cross-margining agreement where collateral is held separately, but paid out jointly in case of loss Fixed Income Clearing Corporation: Have established a cross-margining agreement where collateral is held separately, but paid out jointly in case of loss 	<ul style="list-style-type: none"> Serves multiple markets but does not offer interoperability with other CCPs 	<ul style="list-style-type: none"> Group Linkages: No interoperability links between LCH.Clearnet Ltd and sister CCP LCH.Clearnet SA (jointly held by LCH.Clearnet Group SA). This link is reportedly under consideration Three interoperability links include: <ul style="list-style-type: none"> Swiss CCP SIX x-clear: Clearing of trades executed on the London Stock Exchange and on the SIX Swiss Exchange Swedish CCP part of the NasdaqOMX group: Clears certain equity derivatives executed on NasdaqOMX's linked order book Chicago Mercantile Exchange: Have established a cross-margining agreement where collateral is held separately, but paid out jointly in case of loss

Sources:

CDS website (www.cds.ca); CDS "Organizational structure of the CDS group of companies" (<http://www.cds.ca/documentation/controls/English/CDSclearing.html>); CME Clearing Financial Safeguards (<http://www.cmegroup.com/clearing/files/financialsafeguards.pdf>); CME Group Inc. Standard & Poor's, July 20, 2010; LCH.Clearnet Group Ltd. Standard & Poor's, August 23, 2010

Exhibit 9: Governance – Board of Directors

CDS - FINet	CME Clearing	Eurex Clearing	LCH.Clearnet Ltd
<ul style="list-style-type: none"> Non-profit user owned CCP, which is part of CDS FINet does not have a Board CDS Board based on: <ul style="list-style-type: none"> 66.7% of shares held by banks that appoint 40% (6) directors 15.2% of shares held by Investment Industry Regulatory Organization of Canada which appoints 6.6% (1) director 18.1% of shares held by TSX which appoints 13% (2) directors Shareholders select additional 33% (5) independent directors 	<ul style="list-style-type: none"> CME Clearing does not have its own Board At least a majority of the CME Group Board needs to be independent, non-employee directors 	<ul style="list-style-type: none"> For profit CCP, part of vertically owned organization Eurex Clearing has a separate Supervisory Board with 12 members <ul style="list-style-type: none"> 4 are independent (non Deutsche Börse or SIX members) The remaining members are non-independent (including the chairman of the Supervisory Board of SIX Group A and many Deutsche Börse members) 	<ul style="list-style-type: none"> For profit CCP, part of horizontally integrated company which also owns LCH.Clearnet SA (under the LCH.Clearnet Group umbrella). The group is presently majority user owned <ul style="list-style-type: none"> Pre-2009, exchanges held 45% and Euroclear held another 10% LCH has a separate Board with 12 members 4 of which are independent (including the chairman)

Sources:

CDSX Governance (<http://www.cdsltd-cdsitee.ca/cdsltdhome.nsf/Pages/-EN-Ownershipandgovernance?Open>); CME Group Corporate Governance Recommendations (http://files.shareholder.com/downloads/CME/9696715350x117280/4702a46f-857e-4d2e-a864-e5a3d4cc107be/CME_WebDoc_2334.pdf); CME Annual Report 2009 (<http://investor.cmegroup.com/investor-relations/annuals.cfm>); Eurex Clearing Corporate Governance website (http://www.eurexclearing.com/about/corporate_structure_en.html); Assessment of LCH.Clearnet Limited against the CPSS-IOSCO Recommendations (http://www.lchclearnet.com/images/2009%20CPSS-IOSCO%20Assessment%20of%20LCH%20Clearnet%20Ltd_tcm6-53977.pdf); LCH.Clearnet Ltd Board of Directors (http://www.lchclearnet.com/about_us/corporate_governance/board_of_directors.asp); LCH 2009 Annual Report and Consolidated Financial Statements

Exhibit 10: Governance – Risk Committee

CDS - FINet	CME Clearing	Eurex Clearing	LCH.Clearnet Ltd
<ul style="list-style-type: none"> FINet does not have its own risk committee; this function is run out of the CDS risk committee CDS has three main risk committees <ul style="list-style-type: none"> Board committee: risk/audit committee (board membership) <ul style="list-style-type: none"> Internal: risk management committee External: risk advisory committee 	<ul style="list-style-type: none"> The Clearing House risk committee is composed of at least two co-chairmen and at least seven others, five of which are CM representatives and one non-member The CHRC is responsible for the financial integrity of CMs and CM rules compliance; the risk function appears responsible for the remainder of the risk function 	<ul style="list-style-type: none"> Risk management department is outsourced to the group risk management Risk reporting is performed directly to the Eurex Clearing AG executive management on a monthly basis and on an ad-hoc basis There is no clearing member participation at the group level 	<ul style="list-style-type: none"> Risk Committee is a sub-committee of the LCH.Clearnet Ltd Board Chaired by an independent non-executive board member Its members are user representatives, acting as consultants Even the risk management departments independent from all other departments

Sources:

CDSX Governance (<http://www.cdsltd-cdsitee.ca/cdsltdhome.nsf/Pages/-EN-Ownershipandgovernance?Open>); CME Group Corporate Governance Recommendations (http://files.shareholder.com/downloads/CME/9696715350x117280/4702a46f-857e-4d2e-a864-e5a3d4cc107be/CME_WebDoc_2334.pdf); CME Annual Report 2009 (<http://investor.cmegroup.com/investor-relations/annuals.cfm>); Assessment of Eurex Clearing vs. IOSCO recommendations (http://www.eurexclearing.com/download/about/iosco_assessment_2009_public.pdf); Eurex Clearing 2009 Annual Report (http://www.eurexclearing.com/download/about/annual_report_2009.pdf); Assessment of LCH.Clearnet Limited against the CPSS-IOSCO Recommendations (http://www.lchclearnet.com/images/2009%20CPSS-IOSCO%20Assessment%20of%20LCH%20Clearnet%20Ltd_tcm6-53977.pdf); LCH.Clearnet Ltd Board of Directors (http://www.lchclearnet.com/about_us/corporate_governance/board_of_directors.asp); LCH 2009 Annual Report and Consolidated Financial Statements

Exhibit 11: Operational Risk Management – Backup Plans

CDS - FINet	CME Clearing	Eurex Clearing	LCH.Clearnet Ltd
<ul style="list-style-type: none"> Key operational functions split among two regional offices: Montreal and Toronto Backup secure alternate location with pre-configured computers to support key users not covered by the split operations solution Key personnel have the ability to access systems and perform work remotely Backup centre location not disclosed publicly Full recovery time objectives not publicly disclosed, though these goals are noted: <ul style="list-style-type: none"> Zero for critical and production data through synchronous mirroring of clearing and settlement system 24hrs for SEDAR, SEDI and NRD production data 	<ul style="list-style-type: none"> CME Group operates fully redundant system architectures for all of its key business processes at multiple remote sites, which covers the clearing system Maintains separate data centres in dispersed locations, that are staffed, at all times, with mission-critical personnel Operational requirements, such as utilities, are diversified across multiple providers Full RTOs not disclosed publicly though developed for various processes 	<ul style="list-style-type: none"> Maintain multiple operational and backup facilities Backup centre location not disclosed publicly Full RTOs not disclosed publicly though developed for various processes 	<ul style="list-style-type: none"> They have fully synchronized Backup facilities RTOs noted for: <ul style="list-style-type: none"> Business critical functions are relocated and resumed within 2 hours Separate BCM plans with different RTOs developed for all business units

Sources:
 CDSX Business Continuity (<http://www.cdsltd-cdsltee.ca/cdsltdhome.nsf/Pages/EN-AboutbusinesscontinuitymanagementatCDS?Open>); CME Group Inc. Standard & Poor's, July 20, 2010;
 CME Financial Safeguards (<http://www.cmegroup.com/clearing/files/financialsafeguards.pdf>); Eurex BCM Disclosure (http://www.eurexchange.com/download/documents/publications/BCM_disclosure_document_en.pdf); LCH.Clearnet Group Ltd. Standard & Poor's, June 30, 2009

Exhibit 12: Operational Risk Management – Backup Testing

CDS - FINet	CME Clearing	Eurex Clearing	LCH.Clearnet Ltd
<ul style="list-style-type: none"> CDS conducts tests twice annually The disaster-recovery locations have been used three times: <ul style="list-style-type: none"> During SARS crisis in 2003 in Toronto During the power blackout in August 2003 in Toronto During the G-20 summit 	<ul style="list-style-type: none"> CME Group conducts biannual extensive disaster-recovery testing with key market participants including <ul style="list-style-type: none"> CMS Market data subscribers Partner exchanges and CCPs Key service/data providers (e.g., SWIFT, DTCC, CLS) Settlement banks Functional disaster-recovery drills are conducted at least biannually 	<ul style="list-style-type: none"> Eurex Clearing conducts business-continuity management tests regularly, at least annually 	<ul style="list-style-type: none"> Conducts an annual exercise programme which includes IT Disaster-Recovery, Office Recovery and crisis simulation Business-continuity and disaster-recovery plans are reviewed on an ongoing basis and assessed on a quarterly basis A quarterly report is presented to the risk committee, highlighting the ability of each department to respond to a major incident and detail the maintenance activities that have taken place during the previous quarter

Sources:
 CDSX Business-Continuity (<http://www.cdsltd-cdsltee.ca/cdsltdhome.nsf/Pages/EN-AboutbusinesscontinuitymanagementatCDS?Open>); CME Group Inc. Standard & Poor's, July 20, 2010;
 CME Financial Safeguards (<http://www.cmegroup.com/clearing/files/financialsafeguards.pdf>); Eurex BCM Disclosure (http://www.eurexchange.com/download/documents/publications/BCM_disclosure_document_en.pdf); LCH.Clearnet Ltd IOSCO Assessment (http://www.lchclearnet.com/images/2009%20CPSS-IOSCO%20Assessment%20of%20LCH%20Clearnet%20Ltd_tcm6-53977.pdf); LCH.Clearnet Group Ltd. Standard & Poor's, June 30, 2009;

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