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Who pays? CCP resource provision in the post-Pittsburgh world

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by Jorge Cruz Lopez and Mark Manning

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Who Pays? CCP Resource Provision in the Post-Pittsburgh World

by

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Abstract

At the Pittsburgh Summit in 2009, G20 countries announced their commitment to clear all standardized over-the-counter (OTC) derivatives through central counterparties (CCPs). Since then, CCPs have become increasingly important and there has been an extensive program of regulatory enhancements to both them and OTC derivatives markets. However, as OTC clearing has grown, tensions have emerged among market participants over CCPs' traditional model of resource provision through loss mutualization. We argue that most of these tensions can be explained by a misalignment between the policy goal of enhancing financial stability and the delivery of that goal by mandating clearing through CCPs as they are currently organized. Specifically, the traditional model for resource provision makes most CCPs suitable for managing club goods, whereas financial stability is a public good. The key differences between these two types of goods, driven by the wedge between those who pay for them and those who derive the benefits, create the observed tensions. Thus, we propose a framework to analyze the functional elements of a CCP and examine whether an alternative clearing model might be more effective in supporting financial stability. We conclude that some tensions could perhaps be mitigated by unbundling the functions of a CCP and selecting the ownership and funding structure that best suits their individual characteristics. Functions that are critical for the provision of financial stability might imply some form of public sector involvement, whereas other services might lend themselves to a for-profit or traditional club model.

Bank topics: Financial markets; Financial stability; Financial system regulation and policies

JEL codes: G01, G28

Résumé

Au Sommet de Pittsburgh, en 2009, les pays du G20 ont annoncé leur engagement de procéder à la compensation de toutes les opérations sur les dérivés de gré à gré standardisés par l'entremise de contreparties centrales. Depuis, les contreparties centrales ont gagné en importance, et elles ont fait, de même que les marchés des produits dérivés de gré à gré, l'objet d'une vaste réforme réglementaire. La compensation des dérivés de gré à gré allant croissant, des tensions ont toutefois surgi parmi les participants au marché en ce qui concerne le modèle traditionnel dont se servent les contreparties centrales pour fournir des ressources par mutualisation des pertes. Nous soutenons que la plupart de ces tensions peuvent s'expliquer par l'inadéquation entre le but de la politique – soit améliorer la stabilité financière – et les moyens pris pour l'atteindre – à savoir donner mandat aux contreparties centrales, telles qu'elles sont organisées à l'heure actuelle, d'effectuer la compensation. Plus

précisément, ce modèle traditionnel rend la plupart des contreparties centrales tout indiquées pour la gestion des biens de club, alors que la stabilité financière constitue un bien public. Les tensions observées découlent des principales différences entre ces deux types de biens, différences induites par l'écart entre ceux qui achètent ces biens et ceux qui en retirent un bénéfice. Nous proposons un cadre visant à analyser les éléments fonctionnels des contreparties centrales et à déterminer si un modèle de compensation autre serait mieux à même de favoriser la stabilité financière. Nous concluons qu'il serait peut-être possible d'atténuer certaines tensions en séparant les fonctions des contreparties centrales et en choisissant la structure de propriété et de financement la mieux adaptée à leurs caractéristiques individuelles. Les fonctions essentielles au maintien de la stabilité financière pourraient supposer une forme quelconque d'intervention du secteur public, tandis que d'autres services pourraient se prêter à un modèle à but lucratif ou à un modèle de club traditionnel.

Sujets : Marchés financiers; Stabilité financière; Réglementation et politiques relatives au système financier

Codes JEL : G01, G28

1. Introduction

There has been a wave of regulatory change since the global financial crisis, notably a range of reforms in over-the-counter (OTC) derivatives markets, with the primary objective being to promote financial stability. As part of this, at the Pittsburgh Summit in 2009, there was a declaration that “all standardised OTC derivatives should be...cleared through central counterparties (CCPs).”¹ Policies have since been implemented to meet this objective, including the introduction of clearing mandates for a range of OTC derivatives product classes in all major jurisdictions.

Such mandates, which imply the use of CCPs as a macroprudential tool, have fundamentally transformed the profile and distribution of counterparty risk across the financial system. Dealer banks’ exposures to CCPs are now often among their largest exposures, and the capital and collateral amounts needed to support these exposures have risen substantially (Cruz Lopez 2016). Similarly, banks’ contingent exposures to CCPs’ unfunded losses are now sizable and play a significant role in strategic decisions.²

Recognizing the increased systemic importance of CCPs, international bodies embarked on a multi-year program to enhance the regulatory standards governing these infrastructures. Such standards aim at improving resilience in various ways, but focus prominently on increasing pre-funded financial resources. Should these resources prove insufficient, the standards call for comprehensively addressing any unfunded losses to ensure the continuous provision of critical services.

To this end, CCPs have traditionally adopted a mutualized model for resource provision, whereby clearing members are required to absorb exposures to certain risks managed by the CCP. However, as the reforms have been rolled out, exposures have increased and tensions have emerged between CCP owners, regulators and clearing members. This has led some to question whether the traditional model of resource provision remains appropriate in a world of mandatory clearing, where joining a CCP and signing up to its “club rules” (including rules that can result in substantial contingent exposure for the member) is no longer a private choice (Rundle 2016).

We argue that most of these tensions can be explained by a misalignment between the policy goal—namely, financial stability—and the particular mechanism chosen to deliver on this goal—namely, central clearing through CCPs as they are currently organized. Specifically, we note that in most cases, the design of CCPs, and, in particular, their model for resource provision, makes them suitable for managing *club goods*, where access can be excluded to non-paying market participants. Financial stability, on the other hand, is a *public good*, which allows all market participants to benefit from it. The key differences between these two types of goods, driven by the wedge between those who pay for them and those who have access to their consumption, create the tensions observed.

¹ See G20 (2009).

² The dependence runs in the opposite direction too. In a detailed study of central clearing interdependencies across 26 CCPs in 15 jurisdictions globally, the Basel Committee on Banking Supervision (BCBS) et al. (2017a) observe that the global system of CCPs exhibits high concentrations of exposure to a relatively small number of member banks: 20 members account for some 75 per cent of total exposure across the 26 CCPs in the study, as represented by total pre-funded financial resources. Furthermore, some large members often provide other critical services to CCPs, such as custodial services or liquidity provision.

As others have noted (Kroszner 2006; Moser 1998), central counterparty clearing has evolved over time, adapting to a variety of market and regulatory factors, to eventually settle on the model we most commonly observe today. In this paper, we develop a conceptual framework to examine whether the regulatory changes since the Pittsburgh Summit could be a catalyst for reconsidering the structure of clearing houses. In particular, we present an analysis of the functional elements of a CCP to examine whether an alternative clearing model might be more effective in supporting the macroprudential policy goal of the Pittsburgh commitment. We conclude that the observed tensions could be mitigated by unbundling the functions of a CCP and selecting the ownership and funding structure that best suits their individual characteristics. We observe that the administration of functions that are critical for the provision of the public good of financial stability might imply some form of public sector involvement, whereas other services lend themselves more to a pure for-profit or a traditional club model. A straw-man proposal is set out to stimulate debate on these considerations.

The remainder of this article is structured as follows. We begin with some observations about the current risk characteristics of CCPs and how they have evolved in response to post-crisis reforms. In particular, we describe the circumstances in which CCPs could impose systemic risk externalities. Section 3 considers how these externalities are managed in alternative operating models and exposes the tensions that such models may create. Section 4 explores these tensions in more detail, distinguishing between the loss allocation arrangements that apply for default losses, and those that apply for non-default losses. Section 5 introduces our functional analysis of central clearing, observing that the application of different operating models for certain central clearing functions could help resolve some of the tensions in the current model. Section 6 concludes.

2. CCP Risk Characteristics and Tensions in the Post-Pittsburgh Model of Clearing

The fundamental purpose of a CCP is to centralize the management of counterparty risk to insure traders against non-performance of their counterparties (see Manning and Hughes 2016, Murphy 2013 and Pirrong 2011 for more details). As noted in Cœuré (2017, pg. 98), “As long as CCPs are superior risk managers and act as pillars of strength rather than sources of contagion during potential crisis situations, they act as risk poolers, not risk takers, and they therefore reduce the overall level of risk in the global financial system.” That is, a well-designed and effectively operated CCP can deliver material systemic-risk-reduction benefits, including multilateral netting of exposures, ex ante collateralization of exposures to an “extreme but plausible” level, transparent and contractually agreed ex post loss allocation to deal with beyond-plausible risks, and coordinated default management. Indeed, it was pursuit of these benefits that motivated the Pittsburgh declaration.

However, a poorly designed CCP could, in some circumstances, create and transmit risk rather than absorb it. This section discusses how CCPs can be both positive and negative for financial stability, and considers possible tensions arising from their design.

2.1. CCP risk characteristics

Several authors (including Gregory 2014; Murphy 2012; and Pirrong 2011, 2014) identify some of the channels by which a CCP could create or amplify systemic risk. These include liquidity risk creation (perhaps through margin or collateral haircut procyclicality); transmission of stress

should a CCP's pre-funded resources prove insufficient to cover losses in the event of one or more member defaults; risk shifting, as netting of cleared trades frees members' balance-sheet capacity to take risks elsewhere; "wrong-way" risk (in that mutualized loss allocation is likely to crystallize precisely when members are least able to bear it); and information and incentive issues arising from the mispricing of individual members' contributions to risk.³

Given the risk-reducing benefits of a CCP and the potential channels for transmission of stress, each individual trade submitted for clearing may be regarded as potentially carrying with it both positive and negative systemic externalities. On the one hand, each trade cleared contributes to the opportunities for multilateral netting of exposures, thereby reducing the quantum of risk to be managed relative to a non-centrally cleared counterfactual (Duffie and Zhu 2011). On the other hand, for a given design, each additional trade potentially increases the quantum of risk controlled by the CCP and the potential systemic spillover should a default or non-default shock arise that needs to be managed. Simply put, the more trades a CCP clears, the bigger the opportunity for multilateral netting and for exploiting the other benefits of clearing, but the larger the potential impact of CCP stress.

Drawing on indicators identified by the Financial Stability Board (FSB) in the banking context, Manning and Hughes (2016) observe that the size, substitutability, resources, complexity and scope (including the breadth of its system-wide interconnections, and its cross-border reach) of a CCP's operations will all influence its systemic importance, and therefore its propensity to generate systemic externalities. For a given CCP design, these factors will determine, first, the likelihood that a shock that cannot be directly absorbed by the CCP will materialize, and, second, whether and how any loss or liquidity shortfall that might arise would be transmitted into the wider system.

Some crucial factors affecting CCP risk are exogenous to the clearing house. For instance, it is ultimately the members, not the CCP, that determine the flow of trades submitted for clearing, and therefore the quantum of risk to be managed. However, the CCP's design choices—taken within the parameters of the prevailing regulatory architecture and internal governance arrangements—can influence the cost of clearing and members' decisions, and ultimately determine the balance of positive and negative systemic externalities that the CCP imposes on the financial system.

Who pays for the guarantee that a CCP provides is a fundamental design choice.⁴ That is, if members are mandated to clear their trades via CCPs, a CCP's loss allocation arrangements will determine how stress could potentially be transmitted in the event of a shock. In this context, members may seek to reduce their contingent exposures to the CCP by restructuring their activities to avoid mandatory clearing obligations, or managing their trading (and perhaps hedging) activity to reduce their allocation.⁵ Thus loss allocation arrangements can drive behaviour, which may prove systemically significant.

³ In addition, Marshall, Ruffini and Anene (2017) discuss how under all-or-nothing payouts, central clearing structures are not always more resilient than bilateral structures.

⁴ See Budding and Murphy (2014) for a discussion of this and other design choices in central clearing.

⁵ Where central clearing mandates extend beyond the dealer community, this choice may also influence the decisions of those that access clearing as clients of clearing members. First, members' contingent exposures may be reflected in the pricing of their client-clearing services. And in some cases, the particular loss allocation mechanism introduced by the CCP may directly expose clients to a potential loss. For instance, variation margin gains haircutting (VMGH)—a loss allocation tool that is included in a number of CCPs' recovery plans (see CPMI and IOSCO 2016)—may impose losses disproportionately on clients, since they

2.2. Tensions in the post-Pittsburgh model of clearing

CCPs grew up in association with mutualized exchanges. As such, the usual CCP model includes both an element of mutualized loss allocation (Norman 2011) and some role for clearing members in CCP risk governance.⁶ Over time, there has been a growing tension in this feature. In particular, as the exchanges demutualized in the 1980s and 1990s, so did the clearing houses that supported them; nevertheless, they retained their mutualized loss allocation arrangements (Cox and Steigerwald 2016).

As the post-Pittsburgh reforms have been implemented and the sizes of banks' exposures to CCPs have grown, banks' commitments to CCP loss allocation arrangements have come under increasing scrutiny. Not only are these exposures substantially larger as more derivatives transactions are centrally cleared, but also, under revised bank capital requirements, they no longer attract a zero capital charge. CCP recovery and resolution arrangements can increase these exposures. A particular source of concern for some commentators in this context has been CCPs' allocation of unfunded losses and reliance on the contingent provision of funds from clearing members (JPMorgan Chase 2017) and, in the extreme, their clients (Blackrock 2016).

More generally, as the quantum of risk to be managed has risen, and the systemic importance of CCPs has increased, policy-makers and industry participants alike have sought comfort that the design of CCPs' risk frameworks is adequate to manage the potential systemic consequences of risk concentration. Therefore, calls for tighter regulatory standards for CCP risk management have also grown louder (Bailey 2014; Cœuré 2014, 2015; ISDA 2015; JPMorgan Chase 2014; Murphy 2012; Powell 2014; Tucker 2011, 2014).

It should be noted that risk concentration in CCPs is a deliberate, and indeed inherent, outcome of the policy drive toward central clearing. It is a feature; not a bug. Indeed, it is precisely in recognition of the associated systemic risk implications that the international regulatory bodies the Committee on Payments and Market Infrastructures (CPMI) and the International Organization of Securities Commissions (IOSCO) introduced the Principles for Financial Market Infrastructures (PFMI) in 2012 (CPMI-IOSCO 2012).⁷

However, while the PFMI set exacting standards for CCP risk governance and financial and operational resilience, there is a fundamental source of tension in the current model that is perhaps underappreciated. That is, in the post-Pittsburgh world, CCPs are effectively being used as a macroprudential policy tool in pursuit of financial stability. They have grown in size and

may be more likely to have directional cleared positions that hedge exposures held outside of the CCP. Indeed, a client with directional exposures and a contingent obligation under VMGH might enjoy few direct benefits from central clearing, since it would have limited scope for netting, while bearing a disproportionate cost of "insuring" the CCP in times of stress.

⁶ As Kroszner (2006, pg. 38) notes, in the traditional mutualized clearing model, members have incentives "to support the imposition of risk controls that limit the extent to which the trading activities of any individual member expose all other members to losses from defaults." But importantly, he emphasizes that the effectiveness of such arrangements rests on "the ability to act on such incentives."

⁷ The PFMI and associated further guidance have sought to enhance resilience by adding further rigour to CCPs' risk-governance arrangements, margin practices and stress-testing models. Furthermore, the PFMI require that CCPs establish comprehensive arrangements to address unfunded losses should pre-funded resources prove insufficient. By requiring that CCPs consider all potential sources of risk, the PFMI also illuminate the potential for CCPs to experience losses unrelated to member default, so-called non-default losses. The PFMI have since been rolled out in each CPMI-IOSCO member's legal and regulatory frameworks (CPMI-IOSCO 2017), and a program to further enhance the international regulatory standards that apply to CCPs is under way (BCBS et al. 2017b; FSB et al. 2015).

systemic importance, and the benefits derived from their resilience extend beyond the narrow markets in which they operate. Accordingly, in contributing to loss allocation arrangements designed to ensure that a CCP can operate uninterrupted and absorb stress in all—even beyond-plausible—market conditions, clearing members no longer simply provide a mutual guarantee for the benefit of each other. Rather, they also provide a guarantee for the sake of the much wider good of financial stability.

3. CCP Goods and Operating Models

It is natural to ask whether the current model of CCP resource provision, which emerged to provide privately owned CCPs with loss mutualization among clearing members, remains appropriate now that CCPs have grown and expanded to support a public financial stability objective. The study of different types of goods has a large literature founded in the 1960s (Buchanan 1965; Coase 1960). In this section, these ideas are used to analyze the problem of CCP operating models in the post-Pittsburgh policy framework.

3.1. CCPs and types of goods

Table 1 provides a simple classification of goods based on their rivalrous and exclusion characteristics. The non-rivalrous and non-excludable nature of financial stability makes it a public good. On the other hand, traditional CCP services are non-rivalrous but exclusive, making them club goods.⁸ The classification in Table 1 highlights an important characteristic of the post-Pittsburgh world; that is, expanding the role of central clearing through CCPs in pursuit of financial stability offers a club solution to a public-goods problem.

Specifically, the exclusive character of CCP services is at odds with the public benefits derived from financial stability. For example, to the extent that CCPs are properly managed, all market participants, including those that do not clear their trades, benefit from a more stable market. Related markets and a broader range of stakeholders benefit too. Regulators have addressed this free-rider problem by requiring more stringent capital and collateral requirements for trades that remain bilaterally traded. This policy encourages central clearing and internalizes the risk that market participants contribute to the financial system when they decide not to centrally clear their trades. Similarly, the exclusive nature of CCPs has largely been overridden in some jurisdictions where central clearing of certain derivatives trades is mandatory.

Studying the divergence between the club nature of CCPs and the public good that they are being used to manage can help us understand better the tensions that we observe in derivatives markets and the associated policy responses.

⁸ The non-rivalrous nature of traditional CCP services comes from the fact that, operationally, the marginal cost of clearing an additional trade is very low, and in cases where trades increase netting, the marginal cost could be negative.

Table 1: Classification of goods

	Excludable Only paying participants can have access to the good.	Non-excludable Non-paying market participants can have access to the good.
Rivalrous Consumption by one consumer prevents simultaneous consumption by other consumers.	Private goods	Common-pool goods
Non-rivalrous Consumption by one consumer does not prevent simultaneous consumption by other consumers. Marginal cost of production is zero.	Club goods	Public goods

3.2 Alternative CCP operating models

Many CCPs are now privately owned and feature mutualized (club-like) loss allocation to their members. As we have noted above, this model creates tensions between the rights of and risks borne by shareholders and those of members (Huang 2016; Lewis and McPartland 2017). It may also affect ease of access to clearing, as discussed in CGFS (2011). However, this model is not the only way that CCPs can be organized. In this subsection, we introduce alternative stylized operating models and compare these with the usual model.

The tension between gains going to private shareholders but losses being mutualized is mitigated if CCPs are owned jointly by their clearing members. In these cases, all managerial decisions, and profits and losses related to the CCP, are distributed across clearing members in proportion to their equity interests. Other models are possible too, such as a purely public CCP. To illustrate the characteristics of different CCP models more explicitly, we examine the following three “edge cases”; these reflect competing ideas on how a CCP could be organized:

- (i) The CCP as a club for and owned by its clearing members, providing services to those who wish to join and who meet the membership criteria;
- (ii) The CCP as a public utility; and
- (iii) The CCP as a privately owned and managed financial services company.

When extreme examples of each of these models are considered, the models’ advantages and disadvantages become apparent.

3.2.1 The CCP as a club for members

This model is closest to CCPs in the pre-Pittsburgh era. Here, a group of market participants came together for two reasons:

- to reduce their individual risks to each other through multilateral netting at the CCP
- to centralize the provision of functions they would otherwise have to provide individually, such as portfolio valuation, margin calculation and default management

Membership in a club CCP is clearly voluntary, but once clearing members have joined, they have to adhere to the rules. However, because the CCP is a creature of its members, these rules are set jointly. In this model the CCP can experience stress for various reasons—for instance, if its members do not perform on their obligations. Indeed, there are several examples of CCPs organized on this basis that have experienced stress.⁹

One advantage of the club model is that the risks of the CCP clearly arise from the members collectively, and hence the responsibility for managing them is entirely the members'. As the CCP is a private arrangement, its rules are enforced contractually, through the rule book and private law. Moreover, clubs can compete: there is no reason not to permit multiple clubs serving broadly the same interests, perhaps with overlapping membership.

The primary disadvantage of the club metaphor is that it becomes strained once membership of a CCP becomes compulsory, or very highly incentivized. This is now the case given the regulations requiring market participants to clear standardized OTC derivatives, and capital and margin requirements incentivizing the clearing of non-mandatory derivatives. It now becomes harder to say, "If you don't like the club's rules, don't join."¹⁰ In fact, since economies of scale and network externalities tend to drive the market structure to one or few CCPs per asset class (Duffie and Zhu 2011; Padoa-Schioppa 2007), participants generally have little choice as to which club's rules they sign up to, whether they do it directly as clearing members or indirectly as clients of these clearing firms.¹¹ Such CCPs will clearly be systemically important, and hence require watertight loss allocation and recovery and resolution arrangements that can credibly address the question of how to preserve financial stability when resources available to absorb losses have been fully or nearly exhausted. This in turn challenges the members'-risk, members'-responsibility model that is central to the club CCP concept.

3.2.2 The CCP as a public utility

In this model, a CCP is seen as a public utility like a road or railway:¹² a single-utility CCP is provided for systemically important products, and, to the extent that clearing is mandatory, this CCP must be used. Here the overriding design principle is financial stability, with the CCP seen as vital (inter-)national infrastructure. The CCP in this setting could still have a very substantial layer of resources funded by members to preserve good incentives, with far tail risk absorption being guaranteed by the state. In exchange for this backstop, clearing fees would accrue to the state, and features would be implemented to eliminate any burden on the taxpayer other than the temporary provision of liquidity.¹³

A public-utility CCP would operate under public law, much like any other utility. Indeed, a public-utility model is already observed for CCPs in some jurisdictions, and for certain other

⁹ See, for instance, Budding, Cox and Murphy (2016) for an account of the stress of a New Zealand clearing house, Cox (2015) for one in Hong Kong, and Bignon and Vuillemeys (2016) for one in France.

¹⁰ An alternative may be to access a CCP indirectly via a client clearing provider. However, in part due to the increased capital and collateral costs of clearing, this is not necessarily attractive either.

¹¹ See Domanski, Gambacorta and Picillo (2015) and Manning and Hughes (2016) for a discussion of CCP concentration.

¹² Some areas of CCP activity are, as Tucker (2014) puts it, public functions even if today the CCPs that fulfill them are not part of the state. As a related matter, this means that some CCP activities fall under public rather than private law, as Braithwaite and Murphy (2017) discuss.

¹³ For instance, the state could recoup any sums in addition to funded and callable resources used to stabilize the CCP after losses by imposing higher transaction fees.

financial market infrastructure (FMI) types in many others; most notably, the high-value payment system in many jurisdictions is owned and operated by the central bank. If a public model was deemed appropriate only for highly systemically important transactions, where the benefits of access to clearing in stressed situations are greatest, a public utility CCP in charge of these trades could coexist alongside private or club CCPs clearing other classes of transactions.

The disadvantages of the public utility model include the difficulty of making the systemic/non-systemic determination before the circumstances of financial stress are known, and the potential for a monopoly CCP to stifle innovation in margin calculation or other aspects of clearing. Finally, default management will sometimes require significant market expertise, which will likely have to come from the CCP's members. So, in this aspect of its activities, the CCP may have to operate more like a club than a utility.

3.2.3 Private CCPs for private shareholders

Our final edge case is a model of clearing with fully private, competing CCPs. Here the advantages of competition, innovation and private capital are seen as crucial. In the purest version of the model, there are enough CCPs in any given product that a resolution can always be conducted by transferring a failing CCP's cleared products to a competitor, so CCP shareholders will typically end up owning a bad CCP. For this model to work, CCPs must be both substitutable and able to fail. As noted, there are features in central clearing that tend to produce winner-takes-all outcomes, so a policy-maker seeking to promote competition might pursue policies to encourage diversity of CCPs, such as taxes on dominance in the provision of clearing services. However, if these do not work and resolution by business transfer proves impractical, it might be time-inconsistent for the public authorities to allow a private CCP to fail. Thus, there is still a risk that purely private CCPs might enjoy a too-difficult-to-transfer, too-big-to-fail subsidy.

3.2.4 Summary

The three edge-case models discussed above all have problems in the post-Pittsburgh world. To simplify a nuanced set of issues: the voluntary character of club CCPs does not fit very well with mandatory clearing; utility CCPs may fail to innovate; and the private model entails the potential unfairness of profits for shareholders when things go well but losses for others when things go badly. The conventional solution to this is to blend elements of two or more models into a single CCP—for instance, having club-style governance and loss allocation but a layer of private capital. In section 5, we discuss an alternative, splitting the CCP along functional lines. But first, a more detailed discussion of the sources of CCP risk and their implications for CCP resource provision is necessary.

4. Sources of Risk and CCP Resource Provision

In this section, we examine more closely how various risks are priced, allocated and mitigated in the current model of clearing to inform an assessment of whether there is an approach to CCP resource provision that might resolve observed tensions and better support the macroprudential policy objective of the Pittsburgh commitment. The next two subsections discuss losses arising in the event of member default and non-default losses.

4.1 Losses in the event of member default

The cost of a clearing service is not solely a function of the associated operational costs. Rather, it also encompasses the (contingent) costs of maintaining a “matched book.” In the event of a clearing member default, the CCP must conduct an orderly and timely closeout of the network’s exposure to the defaulted member. If the procedures to manage a default are poorly designed or implemented, or insufficient resources are available to fund the replacement of the defaulted member’s portfolio, the CCP could face unfunded losses that might propagate to other clearing members and the system more broadly.

As we have argued, although the CCP’s design choices set the parameters in which market participants make their trading—and clearing—decisions, it is the members, not the CCP, that ultimately determine the quantum of replacement-cost risk to be managed in a given clearing service. Viewed through this lens, one might argue in favour of a model for CCP financial resources that aims to internalize the potential externalities of members’ choices, either through pricing or by allocating the responsibility to fund any replacement losses and liquidity shortfalls to those that generate the risk. In either case, such an approach would imply a substantial role for the consumers of clearing services—the members—as indeed we observe today.

However, it is by no means straightforward to size, and therefore allocate, the CCP’s potential future exposure to replacement losses associated with the closeout process.¹⁴ Considering the systemic importance of a CCP (and the negative externalities associated with the interruption of its operations), it is typically argued that a CCP’s critical functions should continue even if the operator of the CCP is no longer financially viable and its capacity is impaired. The current debate on CCP resolution heads in this direction, with the expectation often being that the CCP’s functions and obligations could be assumed by a resolution authority should the CCP’s own recovery arrangements fail to restore it to viability and should the conditions for resolution be met; see FSB (2017) for details. The resolution authority may have at its disposal additional sources of funding, as well as business transfer powers or the possibility to take the CCP temporarily into public ownership (e.g., by establishing a bridge entity).

One way to ensure continuous provision of a CCP’s critical services would be to collateralize, in full, all potential future exposure to replacement losses. Assuming for a moment that the full potential future exposure is even measurable, to require full collateralization would almost certainly make clearing so expensive that market participants would find other—probably riskier—alternatives to cleared activity. This argues in favour of pre-funding only up to a plausible statistical expectation of such losses.

The traditional solution, as discussed earlier in this article, has been to require defaulter-pays collateralization (in the form of initial margin) up to a given level of confidence, mutualize losses through pre-funded resources up to an extreme but plausible level, and beyond that point rely on unfunded loss allocation. This approach increases the potential pool of resources available to deal with a default. It also creates good incentives for clearing members to take an active role in the risk governance of the CCP and monitor the credit quality of their peers.

¹⁴ Cruz Lopez et al. (2017) argue that contributions to pre-funded loss mutualization schemes (e.g., default funds) in CCPs do not typically correspond to the amount of risk that market participants bring to the clearing houses, suggesting a potential mispricing of the allocation of contributions. They propose a margin system that takes into account the interdependence of market participants and protects the CCP from multiple defaults. This system also acts as a Pigouvian tax that increases the collateral contributions of members that bring more *homogeneous* risk to the CCP.

A number of factors are relevant to finding an optimal balance between defaulter-pays, owner-pays and mutualized protections (Haene and Sturm 2009), although some traditional theoretical arguments related to the encouragement of clearing members to take an active role in the risk governance of the CCP may be challenged by reality (Cerezetti and Vicente 2017). In particular, the optimal balance should aim to preserve good incentives, while

- aligning risk with reward;
- lowering the cost of clearing by dispersing the system's exposure to tail risk; and
- at the same time avoiding systemic externalities arising from the transmission of stress to surviving clearing members in the event of default.

The ultimate outcome may differ depending on the profile of members and factors such as the ownership structure of the CCP and its own capital contribution to losses (Carter, Hancock and Manning 2016), and the reputation impact for CCP owners of being associated with a stressed CCP.

But can the arguments in favour of mutualization justify *uncapped* loss allocation to members, such as is sometimes observed in CCPs' resourcing arrangements beyond the pre-funded "waterfall"?¹⁵ Arguably not. First, uncapped mutualization might create moral hazard problems. Second, beyond some point, allocation of losses to members (who themselves may be in stress) would probably itself generate negative systemic externalities. And if losses are to be imposed without bound on survivors, this would surely call into question the market's confidence in a CCP's continued ability to provide a replacement-cost guarantee.

The need to preserve good incentives implies that members should bear the cost of managing the tail risk associated with the trades they bring to the CCP; each member would pay in proportion to their contribution to such risk.¹⁶ But there may be no solution that involves the full allocation of unfunded tail risk to members. Instead, losses may have to be dispersed *beyond* the clearing members if the systemic externalities from having the members bear these losses would otherwise be too great.

The absence of credible ex ante arrangements to allocate losses beyond members in such circumstances could give rise to a time-inconsistency problem. That is, it may not be credible for the state to rely on the CCPs' pre-agreed loss allocation to members in recovery. Indeed, once we clearly frame financial stability as a public good, an argument could potentially be made for some form of public support for the CCP—or, at least, temporary public funding, with clawback from industry ex post—beyond a far tail systemic threshold and if in the public interest.¹⁷ The key here is how such a systemic threshold should be determined. Incentive considerations suggest that public support should arguably be relied upon only for truly catastrophic losses, subject, of course, to the financial stability (public good) benefits outweighing the costs of providing such support in

¹⁵ The PFMI require that FMIs' recovery plans be comprehensive. A typical "end-of-waterfall" structure for a CCP comprises a layer of unfunded contributions from members, haircutting of variation margin (often for a defined period, or up to a cap) and, as a last resort, "tear-up" of cleared contracts (CPMI-IOSCO 2016).

¹⁶ To the extent that members bear the tail risk, the clearing fee should be set in such a way as to ensure that the CCP does not earn a profit from risks that it does not bear. It is also important that the CCP makes some contribution to the waterfall to preserve good incentives for the CCP to manage risk (see Carter and Garner 2016; Murphy 2017). If the CCP makes a material contribution to the waterfall, the cost of committing these funds would be expected to be passed on to the members.

¹⁷ As Singh (2014) discusses, CCPs tend to jump to stress rather than (as banks often do) descend slowly into it. This makes intervention well before the point of non-viability much more difficult.

crisis.¹⁸ The benefit provided by this backstop should be properly priced so that taxpayers enjoy a revenue stream in exchange for the far tail backstop they are providing.¹⁹

4.2 Non-default losses

As described in the previous sections, regulatory and market pressures have led CCPs to develop sophisticated practices to manage the default of individual clearing members. On the other hand, the management of non-default losses (NDLs) has received less attention from both regulators and industry participants. This is despite the fact that the PFMI establish standards for the management of NDLs, with specific principles for legal, business, investment, custody and operational risks.²⁰

Table 2 provides a framework to identify and classify NDL exposures based on their risk sources. At a high level, NDL exposures can be divided into those that arise directly from clearing and settlement activities, including those that entail interactions with other sectors of the financial system (e.g., other FMIs, custodians, investment counterparties and settlement banks), and those that arise from operational systems or strategic business decisions. The exposures of a CCP are ultimately determined by the investments it makes or the contingency arrangements it establishes to manage relevant sources of risk.

Several challenges need to be addressed when developing a framework for managing NDLs. These include the problems of identifying the stakeholders responsible for the actions that led to a loss exposure, allocating responsibility for losses fairly between responsible stakeholders, and creating good incentives.

In terms of stakeholder responsibility, some NDL exposures, such as the legal risk arising from the rule book, are fully within the control of the CCP. Therefore, an argument could be made that the CCP should absorb the losses derived from such exposures. However, there are other exposures that the CCP can influence only partially. Take, for example, investment risks. These are determined by the interaction of a CCP's margin and investment policies and clearing members' trading activity, including their decisions to pledge certain assets as collateral. Essentially, the CCP sets its policies for managing investment risks, given a set of external constraints (e.g., access to central bank facilities, payment systems and custodians), and clearing members determine the inputs to this function. If clearing members pledge cash and the CCP does not have access to a central bank account, the CCP must invest the cash in securities that carry market, credit and liquidity risk. However, if the CCP has access to a central bank account, many of these risks may be mitigated. Similarly, when clearing members pledge securities, the CCP restricts the set of acceptable securities and custodians, which influences, but does not fully determine, its residual exposures.

¹⁸ The argument is no different than that for any other public good. Take, for example, a public road. This would be funded by users' motor vehicle licences up to a reasonable estimate of the ongoing cost of maintenance and servicing. But if a natural disaster occurred that washed away the road, it would be reasonable to expect the taxpayer to fund the repair costs at least in the short term, perhaps recouped by a special levy on motorists over a period of time.

¹⁹ The usual objection to a public backstop is moral hazard. However, this is significantly mitigated if it is far in the tail of the loss distribution, subject to a public interest test with the associated constructive ambiguity, properly priced ex ante, and subject to claw-back ex post. It would also be expected that the state's potential future exposure was mitigated by ongoing rigorous supervision.

²⁰ For a more comprehensive discussion of NDL allocation, see Lewis and McPartland (2017).

Despite the limited control a CCP has over its investment risk, most CCPs do not take into account NDL exposures when calculating margin requirements or mutualized fund contributions. This is because NDL exposures are uncertain and, at best, very difficult to quantify ex ante. As a consequence, contributions to margin and default funds are generally not available for offsetting potential NDLs. Instead, to partially manage this risk, many CCPs have established arrangements whereby, beyond a specified threshold, any investment losses arising would be allocated to members or offset with CCP capital. However, NDLs can be broader than investment losses so the occurrence of a large NDL could erode the capital of a CCP and trigger its failure, even if its cleared book remains balanced (LCH 2016).

Table 2: Risk sources of non-default losses in CCPs

Risk Type	Definition/subtype	Illustrative examples
Investment and custody risk	Market risk: Potential decrease in the value of investments funded with cash margins that leads to uncovered exposures	<ul style="list-style-type: none"> - Interest rate risk on purchased bonds - Default risk on bond issuers
	Credit risk: Potential loss of margin funds due to the default of an investment counterparty or the failure of a settlement bank or FMI	<ul style="list-style-type: none"> - Default of a commercial bank providing deposits to the CCP - Default of a repo counterparty - Failure of a custodian - Failure or losses caused by disruptions in payment systems
	Liquidity risk: Potential delay or excessive cost in accessing sufficient liquidity to honour the CCP's obligations	<ul style="list-style-type: none"> - Failure to make required margin payments - Insufficient liquidity available to conduct timely default management
Business, operational and strategic risk	Legal risk: Potential losses arising from the inability to enforce institutional rules or failure to comply with statutory or regulatory obligations	<ul style="list-style-type: none"> - Unenforceability or illegality of rule book or other contractual provisions - Conflict of law across jurisdictions - Failure to meet legally required standards of action or decision making
	Technology/cyber risk: Potential losses arising from failures of information technology systems	<ul style="list-style-type: none"> - Unavailability of communications systems - Compromise of integrity or confidentiality - Theft of data
	Other risks	<ul style="list-style-type: none"> - Fraud risk - Business risk

It is important to note that CCPs tend to operate with relatively low levels of equity capital because of their matched book profile and traditional structure as clubs. This means that CCPs' ability to absorb NDLs they cannot allocate may be low. Given this, in the post-Pittsburgh era of mandated central clearing, perhaps we should consider more broadly CCPs' arrangements for assigning NDLs beyond capital to balance the viability of CCPs with their macroprudential role of managing the public good of financial stability.

In particular, the public-goods nature of some NDL exposures could inherently lead to systematic underinvestment of resources. In other cases, achieving adequate coverage might lead

to costs that are too high for any given CCP to absorb or for clearing to remain economically feasible. Consider, for example, cyber risk. The stability and resilience of information technology (IT) networks is a public good, particularly as the scale of such networks increases (see Table 1). If a CCP invests to keep its networks safe from cyber attacks beyond the standards of its competitors, every other CCP benefits from “herd immunity” and from having the option to adopt management solutions at a fraction of the cost (e.g., by avoiding research and development costs). In addition, unlike other operational risks, cyber risk has a predatory nature in the sense that hackers aim at eroding risk management systems and constantly innovate to defeat the latest and most sophisticated defences. As a consequence, even if a CCP were to adopt the best cyber risk management practices at any given time, it is possible that it could suffer a cyber-attack in the future. In such circumstances, no single CCP would have sufficient incentive to fully cover its cyber exposure.

Therefore, just as we argued in section 4.1 that there could be a case for some form of public support for a CCP in the event of default losses beyond a threshold, an argument could perhaps be made for some form of public sector role in addressing certain NDIs where the private management of the associated risks could render clearing uneconomical, or where the public goods nature of the associated risks could lead to systematic underinvestment.

5. A Functional Analysis of Central Clearing

The foregoing discussion has exposed a number of issues with the model of resource provision in the post-Pittsburgh world, which at heart arise from the pursuit of a public objective with a model designed for a club service. In the discussion, we have identified a number of areas where some public sector involvement might be appropriate. However, as observed in section 3, organizing central clearing entirely as a public utility might have a number of drawbacks, including in the areas of innovation and incentives. Ultimately, it would be undesirable to introduce a bigger role for the public sector than is strictly necessary to effectively deliver the public good of financial stability.

To better tailor the ownership and operating model to the nature of the service to be provided, it is instructive to think more deeply about the various functions that a CCP performs. A typical CCP has the following functions:²¹

- (i) It calculates collateral haircuts and initial margin and default fund requirements.
- (ii) It provides a technical interface to market participants and services cleared portfolios, providing portfolio and collateral valuations, matching services, portfolio compression, etc.
- (iii) It closes out the portfolios of any defaulters.
- (iv) It is a counterparty to cleared trades.
- (v) It has custody of margin and reinvests cash collateral.

These functions are very different in their character and systemic implications. In this section, we look at how to group these functions according to whether they are most effectively provided by a model with a private, club or public orientation.²²

²¹ For a more detailed discussion of CCP functions, see European Association of CCP Clearing Houses (2004).

²² Both Pirrong (2010) and Murphy (2013) discuss various splits of CCP functions; Pirrong (2010, pg. 31), for instance, notes that “[t]here is no logic that says that those functions have to be bundled.”

- *Functions with a private orientation.* Function (i) is the area in central clearing where competition and innovation are most important: advances in margin calculation and stress testing/default fund sizing are important, subject to appropriate regulation. Moreover, clients and clearing members may have different preferences and opportunity costs in this area of CCP operations, with clients sometimes preferring lower initial margin and more mutualization, and clearing members the reverse.
- *Functions with a club orientation.* In contrast, functions (ii) and perhaps (iii) have more of a club orientation. Function (ii) involves cooperation between firms, the development of common standards, and the use of industry consensus methodologies. Operational risk resulting from function (ii) can reasonably be mutualized. Function (iii), at least for OTC derivatives, is typically met using a default management group composed of industry secondees, so it also suits a club-style approach.
- *Functions with a public orientation.* The systemic consequences of the failure of a CCP are most significant as they relate to functions (iv) and (v). If the central counterparty in a cleared market was unable to meet its obligations, market disruption would be inevitable. Moreover, some of the largest potential NDLs are those that arise from losses on reinvested cash collateral in the absence of access to central bank facilities, so here, too, neither club nor private approaches would seem to be optimal.

The separation proposed above suggests that the different functions of a CCP could be carried out under different operational and organizational frameworks. One possible structure, for instance, might be to explicitly back extreme tail risk on a common netting set by an industry fund and/or the state's ability to levy taxes on future transactions.²³ Privately owned and operated margin and default fund calculators could then compete for fixed-term licences to operate on the common netting set subject to regulatory standards, much as train-operating companies bid for licences to operate services on state-owned track.²⁴ The natural monopoly of providing portfolio services could then be met by an industry-owned utility operated on a club basis.

One advantage of this model is that the privately owned components could be allowed to fail more easily if their failure did not lead to tear-up or to the inability to access clearing services. Thus, resolution may well not be necessary for the private elements. Moreover, the most systemically important functions would be explicitly backstopped, reducing the risk of financial instability arising from concerns about the stability of the trade counterparty and owner of the margin.

²³ See also Lubben (2014), Pirrong (2014) and Tucker (2014).

²⁴ An interesting question that arises in the design of a CCP with multiple margin calculators using the same netting set is how to allocate default losses between the waterfalls associated with each margin calculator. One approach might be to treat each margin calculator as a silo, and therefore losses fall where they arise, depending on the portfolio under each calculator. A variant of this would have losses entering other calculators' default funds only if the affected calculator's default fund was exhausted. However, a more efficient approach might be to allow some pooling according to a more or less granular definition of products. In this way, any excess margin on the defaulter's portfolio under one margin calculator for a given product could be used to offset losses on the defaulter's portfolio under another calculator for the same product. The allocation of losses under such a model would ultimately be weighted towards the least-conservative margin calculator.

6. Concluding Remarks

This article has examined emerging tensions in the post-Pittsburgh model of CCP clearing, which we argue arise from the fact that CCPs have, in essence, been adopted as a macroprudential tool to pursue the public good of financial stability. With this observation as the starting point, we have considered whether the new order has so fundamentally altered the nature of the good that CCPs provide that the traditional club operating model is no longer fit for that purpose.

In particular, we have argued that—in *extremis*—there may be a case for some form of public backstop to the capped resources provided by the immediate club of members. There may also be a case for public involvement in the management of exposures to certain types of non-default losses, such as those arising from a cyber threat, where the private management of the associated risks could render clearing uneconomical, or where the public-goods nature of the associated risks could lead to systematic underinvestment.

That said, we have fallen far short of suggesting that CCPs be operated as public utilities. Rather, as a straw man to advance the debate, we have considered whether it might be feasible to decompose the CCP's functions into its discrete elements and tailor the operational and organizational framework to the particular characteristics of each. Under such an approach, it may be possible to isolate the functions that are truly critical to the provision of the public good—multilateral netting of novated trades, custody of margin and reinvestment of cash collateral—and establish an explicit public backstop for these, while allowing other functions to be provided under models with either a private or a club orientation.

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