A Bill of Goods: CCPs and Systemic Risk

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I. Introduction

In the aftermath of the Financial Crisis, G-20 governments agreed that central clearing of over-the-counter (OTC) derivatives would play a pivotal role in reducing systemic risk. These governments made commitments to mandate the use of central clearing for "standardized" derivatives transactions. These mandates are in place in some countries (including the United States, as a result of the Dodd-Frank Act) and the process of implementing the clearing requirement is well underway in other jurisdictions.

Several beliefs about clearing provide the justification for these mandates:

- By allowing more extensive netting, central counterparties ("CCPs") reduce risk exposures in the financial system.
- CCPs will implement rigorous collateralization (margining) of derivatives transactions, which will reduce counterparty risk in the system, and reduce the potential for the insolvency (or illiquidity) of one major derivatives trader causing the insolvency (or illiquidity) of other major financial institutions.
- Clearing will reduce the interconnectedness of the financial system, thereby reducing the potential for contagion.

Ironically, none of these claims about how clearing reduces systemic risk withstand scrutiny when one analyzes the effects of clearing from a truly systemic

perspective. These claims are typically based on analyses that (a) evaluate clearing and derivatives markets in isolation from the rest of the financial system, and (b) do not consider how the financial system will change in response to a major intervention such as a clearing mandate.

Netting through CCPs is widely considered systemically stabilizing because it reduces derivatives exposures at systemically important financial institutions (SIFIs). When derivatives are viewed in isolation, netting does indeed reduce risk. However, the primary effect of netting is to redistribute risk to elsewhere in the financial system, and derivatives-centric analyses overlook this truly systemic implication. Specifically, netting redistributes risk away from derivatives counterparties and towards other creditors of bankrupt firms. Since these other creditors (e.g., money market funds) (a) may be systemically important, and/or (b) may have incentives to "run" from financially troubled financial institutions with derivatives positions, this redistribution can be systemically destabilizing.

Increasing collateralization is also considered to be systemically stabilizing because it reduces the amount of leverage-and hence counterparty credit risk-in derivatives trades. Yet again, however, a truly systemic analysis undercuts these claims. Like netting, more extensive collateralization of derivatives exposures elevates the priority of derivatives claims in bankruptcy, and can have similarly equivocal effects on systemic risk. Moreover, although viewed narrowly collateralization appears to reduce the interconnectedness (*via* credit risk exposures) of the financial system, this fails to account for the fact that market participants can-and will-substitute other forms of credit (which may be quite

fragile) for that previously embedded in bilateral derivatives trades, making the net effect of derivatives collateralization mandates on total credit exposure, fragility, and interconnectedness uncertain.

Clearing (which necessitates margining) and collateralization of bilateral exposures introduces other potential sources of instability. Real world margining systems tend to be procyclical, which can introduce perverse feedback mechanisms, particularly during periods of systemic stress.

Furthermore, the rigidities of frequent variation margining (and marking-to-market) create tight couplings in financial markets that can be extremely destabilizing during periods of stress. Variation margining causes sharp increases in the demand for liquidity during periods of large price movements—periods that also tend to be associated with contractions in liquidity supply. Thus, rigid variation margining and marking-to-market tend to cause involuntary liquidations of losing positions and fire sales in illiquid markets which can exacerbate systemic stress.

Indeed, in most historical financial crises, including the most recent one, margin calls have functioned as a vector of contagion and instability. Consequently, the increased reliance on collateralization and frequent marking-to-market of derivatives positions can be highly destabilizing during periods of financial stress. Thus, when the dynamics of margining and mark-to-market are considered, these measures may be micro-prudentially sensible but macro-prudentially problematic.

Increased collateralization of derivatives exposures (especially *via* CCPs) also exacerbates wrong-way risk exposures. CCP default funds-which are an exposure of systemically important financial institutions—are most likely to be hit during

periods of severe financial turbulence, which is precisely when SIFIs are most vulnerable.

Insofar as interconnections are concerned, CCPs change the topology of the network of connections in the financial system. Most notably, many market participants who were formerly connected directly *via* bilateral contracts are still connected *via* exposures to CCPs, including most notably SIFIs via CCP default funds. Moreover, since firms may belong to, or clear through, multiple CCPs, CCPs are connected indirectly. Furthermore, mandated clearing will induce changes in financial contracting-such as "collateral transformation"-that will serve as new connections. The effects of these changes on the topology of the financial network, and the stability thereof, are extremely difficult to predict.

Lastly, the incentives CCPs face, and the information that they possess, make them problematic guardians of the stability of the entire financial system. CCPs are effectively the agents of some participants of one part of the financial system, and have incentives to take actions that benefit these participants. In a tightly coupled financial system, actions intended to protect the safety and soundness of one institution or group of institutions can destabilize other parts: for instance, increasing margins during periods of systemic stress and illiquidity can be prudent for CCPs but can have detrimental consequences elsewhere in the financial system. Moreover, even if they attempted to act as agents for the system as a whole, rather than their members and particular markets, CCPs do not have the information necessary to evaluate the systemic effects of their actions.

When all of these considerations are weighed, the case for CCPs becomes much more equivocal. CCP mandates will have numerous unintended consequences, and as a result, they may reduce the stability of the financial system in some circumstances-even if they increase stability in others.

These potentially adverse consequences can be anticipated, and perhaps mitigated or even eliminated if they are understood more fully. Forewarned is forearmed. Such an understanding must be predicated on a truly systemic analysis. Unfortunately, that has been far too rare in the literature or the policy debate on clearing mandates. This paper is by no means an exhaustive or definitive treatment of this incredibly complex subject. Instead, it will have served its purpose if it points out some the issues that scholars and policymakers need to address in order to reduce the odds that the purported mitigant of some systemic risks will create others.

The remainder of this article is organized as follows. Section II analyzes the systemic impact of netting, and Section III does the same for collateral. Section IV examines how the mandating of clearing affects the degree of interconnectedness in the financial system, and the nature of the interconnections. Section V evaluates the incentives of CCPs to act as regulators of systemic risk, and whether they have the information necessary to perform this role. Section VI summarizes.

II. Netting

A. The Purported Benefits of Netting

Most advocates of clearing emphasize the role of netting in reducing counterparty exposures, often through the use of a simple example that goes

something like this. Firm A has sold 100 contracts to firm B, which has sold 100 contracts to firm C. Total open interest in the contract is 200.

Even though B's price exposure is flat, A and C are exposed to B's credit risk. Regardless of which way prices move, either A or C will have an in-the-money position with B, and can suffer a counterparty loss as a result if B defaults.

Netting eliminates B from the contractual chain, reduces open interest from 200 to 100, and reduces credit exposure commensurately—if the contracts between A, B, and C reflect the entirety of the financial exposures in the economy.

Market participants can engage in bilateral (close-out) netting under US bankruptcy law. In the previous example, no such netting was possible (or it was already reflected in the positions given). Clearing facilitates multilateral netting.[1] If the contracts in the example were cleared, since all trades go through the CCP, B's 100 long and 100 short contracts with the CCP would be eliminated, and after clearing is complete A would have 100 contracts sold to the CCP and B would have 100 contracts bought. Exposure would be reduced, because no one remains exposed to B's credit risk.

This reduction of credit risk-in the context of the example-is one of the purported benefits of clearing. This benefit is illusory, however, because it views derivatives exposures in isolation.

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[1] Multi-lateral netting is possible even in bilateral markets. For instance, prior to the adoption of clearing at the CBT in 1925, groups of market participants like A, B, and C would form "rings" to net out, on a voluntary basis, offsetting exposures. For example, if A, B, and C formed a ring, the contracts between A, B, and C would be replaced by a 100 contract sale from A to C, thereby eliminating B from the contractual chain. At present, "tear up" and "compression" services perform the same functions in OTC derivatives markets.

B. Clearing Does Not Necessarily Increase Netting

The foregoing example assumes that there is a single risk in the economy. In reality, derivatives users trade a variety of contracts through the same counterparties. For instance, A, B, and C may trade both swaps and swaptions, or IRS and CDS. Although these trades in different instruments cannot be eliminated *via* netting (as only identical contracts can be eliminated by netting), in the event of a default, gains on one instrument in a defaulter's portfolio can be set-off against losses on other instruments if they are cleared through a single CCP. Alternatively, even if there are losses on each instrument or category of instrument, losses may be larger than collateral posted on some of them but smaller than collateral on others: the excess collateral on some positions can be used to cover the collateral deficiencies on others if they are all cleared through one CCP. These various offsets reduce loss conditional on default, as compared to the credit loss on derivatives transactions that would be realized if different instruments are cleared on different CCPs, or if they remain bilateral.

This proved important in the Lehman default. Lehman traded five different categories of futures and futures options (interest rate, equity, agriculture, energy, and FX) on the CME. The losses on its positions were larger than collateral posted on two categories of positions, but smaller than collateral posted on the other three: the excess collateral more than offset the collateral deficiencies, meaning that the CME clearinghouse and its members did not suffer a loss as the result of Lehman's default.

These effects can also work in bilateral markets. A dealer that trades a variety of instruments with a defaulting counterparty can offset gains and losses across instruments and utilize collateral posted on all positions to cover any losses.

Thus, the effect of a CCP mandate on counterparty credit losses depends in part on how implementation of the mandate affects these netting and offset possibilities. In particular, the formation of single-class CCPs (e.g., interest rate derivative CCPs, CDS CCPs, etc.) facilitates multilateral netting within a product class, and some potential for offset (e.g., index vs. single name CDS), but breaks up netting sets across products in dealer banks. Pirrong (2008) and Duffie and Zhu (2012) demonstrate that it is impossible to determine *a priori* whether the effect of the clearing of a subset of products on single-category CCPs increases or reduces netting economies. Thus, to the extent that clearing mandates lead to the formation of single-category CCPs (which has happened at the outset), it is uncertain whether CCP mandates have or will reduce default losses suffered by derivatives counterparties. The potential for fragmentation even within product classes across jurisdictional lines (e.g., separate IRS CCPs in the EU and UK or US) increases the likelihood that clearing mandates will actually reduce netting benefits for derivatives market participants.

To the extent that netting does in fact reduce systemic risks, as its advocates suggest, the fact that clearing mandates may actually reduce netting benefits implies that these mandates might actually increase systemic risk. But as I discuss next, the premise that netting reduces systemic risk is faulty. Indeed, because of the redistributive effects of netting, there is no necessary connection between the

magnitude (or sign) of netting effects and systemic risk. Systemic risk can actually increase if clearing on balance increases netting effects, and systemic risk can fall if the reverse is true.

C. Netting Redistributes Risk, Rather Than Eliminates It

There is a more fundamental problem with netting that bears directly on the issue of systemic risk. Specifically, when viewed systemically, the primary effect of netting is to redistribute credit losses, rather than reduce them (Pirrong, 2009, 2010a-c, 2011, 2012; Roe, 2013). This redistribution can either reduce or increase systemic risk. Thus, identifying netting effects in derivatives transactions—which are front and center in many defenses of clearing mandates—are not sufficient to determine whether clearing mandates increase or reduce systemic risk.

This point becomes clear when the cartoon example just presented is made even slightly more realistic, through the introduction of other claims on A, B, and C. In this example, B buys 1000 contracts from A, and sells 2000 contracts to C: in the absence of clearing, both of these positions remain open. Aside from the derivatives exposure (which could be an asset or a liability), B has $1 billion in assets and $750 million in liabilities.

B defaults when it has a loss of $1 billion on the short position, and a gain of $500 million on the long position. B's total liabilities are $1.75 billion (the $750 million in other liabilities and the $1 billion liability associated with the short position) and assets of $1.5 billion. In bankruptcy, each creditor (C and the firm's other creditors) receives about 86 cents on the dollar. Thus, C receives about $860 million and other creditors receive around $650 million.

Now consider the payoffs with clearing. With clearing, multilateral netting reduces B's position to a 1000 contract short position to the CCP. The firm's liabilities are now $1.25 billion attributable to a loss of $500 million on the short position and the non-derivatives liabilities of $750. The firm's assets are now $1 billion.

In bankruptcy after the default, derivatives counterparties receive (.5)($500 million)+(.5)(.8)($500 million)=$900 million, i.e., 90 cents on the dollar.[2] Other creditors receive $600 million, i.e., 80 cents on the dollar.

Note that clearing has redistributed approximately $50 million from other creditors to the derivatives creditor C. This occurs because without netting, the amount that derivatives counterparty A owes B is shared between the other creditors and derivatives counterparty C. With clearing and netting, in contrast, the full amount owed by A on its derivatives position is paid to the CCP, which then passes this amount on to C: A's other creditors do not share in this money.

Netting therefore increases the priority of derivatives counterparties over other claimants on bankrupt firms with derivatives positions. Thus, it redistributes risk of loss from one set of claimants to another: it does not reduce counterparty losses throughout the entire financial system, even if it reduces such losses on derivatives trades.

This redistribution does not necessarily reduce systemic risk. A major source of systemic risk is the risk of runs on large financial institutions. Some large derivatives traders, especially dealer banks, are vulnerable to runs because they

[2] C may be repaid in full, and members of the CCP incur a cost of $100 million.

have substantial maturity mismatches: they fund long-term assets with short-term liabilities. Prioritizing derivatives makes it more likely, all else equal, that holders of these short-term claims will suffer a loss in the event of bankruptcy, and thereby increases their incentive to engage in an inefficient run that causes a default by a large financial institution.

Moreover, the effect can be indirect. These short-term liabilities may be held by entities with run-prone capital structures, such as money market funds. Fund depositors have an incentive to run when the risk of "breaking the buck" increases. Elevating the priority of derivatives, at the expense of claims held by the funds, increases the likelihood that this will occur.

Of course, raising priority of derivatives reduces the incentive of derivatives counterparties to run.[3] This is one argument commonly advanced for derivatives safe harbors and clearing. But the run risk is not necessarily reduced so much as redistributed. It is nigh on to impossible to know whether this redistribution is an improvement on balance. It may not be. Or it may be under some sets of circumstances, but not others.

This uncertainty about the net effects of changing priorities *via* clearing (or safe harbors) is even more profound when it is recognized that these changes will induce changes in capital structures, and the pricing of debt and equity. The prices of different corporate claims depend on priorities, and market participants can adjust capital structures over time in response to such price changes. In general, it is impossible to make any predictions on what post-mandate capital structures will

[3] Though it does not eliminate it. See Duffie (2011).

be, and how they will differ from existing capital structures. Consequently, it is impossible to make any predictions about the systemic fragility of these structures.

But it *is* possible to say that clearing mandates will induce adjustments in the capital structures throughout the financial system, and that these adjustments will affect the risk of the system. This implies that analyses of netting that make assertions about the effects of netting on systemic risk that are based solely on its effects on derivatives counterparties, and which (a) do not take into account the redistributive effects of netting for a given capital structure, and (b) fail to consider how mandated derivatives netting will affect capital structures throughout the financial system, are flawed. They are flawed because they ignore the full systemic effects of netting driven by CCP mandates.

III. Collateral

A. The Arguments in Favor of Greater Collateralization

Collateral—margining—is a way of reducing credit exposure in derivatives transactions. The collateral posted by a defaulting counterparty can be used to cover any losses on its derivatives positions. Collateral is intended as a way of making sure "losers pay."

CCPs implement rigorous and rigid collateralization mechanisms. They require parties with open positions to hold initial margin ("IM") that can be accessed in the event of a default. CCPs choose IM levels to cover losses with a very high probability (e.g., 99.7 percent) on defaulted positions that may be incurred before they can be liquidated or hedged. Hence, margins tend to be higher in volatile markets, and for less liquid products that take longer to hedge or liquidate.

Moreover, CCPs utilize variation margin ("VM"). With variation margining, on a periodic basis positions are marked to market ("MTM"), and those who have suffered losses since the last MTM cycle must pay these losses to the CCP in cash, usually within hours. VM payments are made at least daily, and sometimes multiple times in a day for some market participants. The CCP transfers the VM payments of those suffering MTM losses to those enjoying MTM gains.

These margin mechanisms substantially reduce the risk that anyone—the CCP, its members, or clients of its members—will suffer a counterparty credit loss. Indeed, in the aftermath of the Lehman default, both CME and LCH.Clearnet touted the fact that they had suffered no counterparty credit losses to Lehman: Lehman's collateral more than covered the losses on its defaulted positions.

In this way, collateralization reduces the amount of leverage, credit, and credit risk in derivatives transactions, as compared to uncollateralized transactions, or especially as compared to many bilateral contracts which actually embed credit—negative collateral, if you will.

Thus, when one confines one's attention to derivatives alone, increasing collateralization reduces credit risk: more precisely, it reduces the risk that a derivatives trader will suffer a credit loss due a counterparty's default. To the extent increasing collateralization through clearing mandates or mandatory collateralization of uncleared trades reduces credit exposure, derivatives cannot be a *direct* source of contagion through a counterparty credit risk channel. The losers almost always pay in full—on their derivatives contracts—and hence losses on these contracts cannot be a direct source of systemic risk.

This represents one of the main arguments for clearing and collateral mandates. But like the netting argument, it is not complete, and more to the point, it is not truly systemic in scope. Like the netting argument, it overlooks the redistributive effects of collateralization. Moreover, it does not take into account the fact that market participants can adjust capital structures on other decision margins to offset in whole or in part the impact of increased collateralization of derivatives; nor does it consider the systemic riskiness of these new capital structures. Furthermore, it fails to consider the feedback effects that the CCP collateralization mechanism can create that wreak havoc elsewhere in the system. Finally, it does not take into account how more extensive collateralization creates "wrong way risk" that is particularly pernicious, and systemically dangerous. I consider each point in turn

B. Collateralization Redistributes Risk, Rather Than Eliminating It

Like netting, collateralization (combined with legal provisions that give CCPs or others with collateralized derivatives positions that permit them to seize this collateral) improves the priority of derivatives contracts in bankruptcy, relative to other claims on the bankrupt derivatives trading firm. This reduces the counterparty credit losses on derivatives trades, but increases the counterparty credit losses suffered by other claimants: this increases the likelihood that these other claimants' losses can lead to their insolvency or illiquidity, which can in turn affect the solvency and liquidity of their counterparties. Thus, collateralization constricts one channel of contagion, but widens others. And as with netting, this redistribution tends to reduce the incentives of derivatives counterparties to run,

but increases the incentive of other claimants (direct or indirect) to run. *A priori* it is not evident whether these lead to a more or less risky financial system.

C. Market Participants Can "Undo" Mandated Increases in Collateralization

Reducing the credit exposure in one set of a firm's financial contracts *via* mandated collateralization does not imply that the firm's total credit exposure declines because it can adjust its remaining set of financial contracts to offset, in whole or in part, the effect of the collateralization of the one set. Similarly, even if credit exposures in derivatives transactions in the system as a whole decline, total credit exposures need not decline due to the ability of market participants to add leverage elsewhere (Pirrong, 2009, 2010a-c, 2011, 2012).

Mello and Parsons (2012) provide a simple example. They show that an uncollateralized derivatives contract is equivalent to a collateralized derivative combined with a credit line from the counterparty. Mandating collateralization induces the parties to the contract to unbundle the two components, leaving total credit exposure unchanged. In essence, the derivatives trader borrows the money from the counterparty bank. Total credit risk is unchanged.

There are other ways that market participants can use other forms of credit to fund initial margin. One likely mechanism is "collateral transformation" whereby a firm owning collateral that cannot be used as initial margin at a CCP enters into a repo transaction with a financial intermediary to obtain CCP-eligible collateral. That is, ineligible collateral is used to obtain funds that are posted as IM as a CCP.

This transaction essentially replaces one form of credit that is bundled with a traditional OTC derivative with another form of credit: borrowing secured by low-

quality assets. Thus, reduction in credit resulting from the mandating of clearing is smaller than the derivatives-centric analysis would suggest, and may be completely non-existent.

Furthermore, some of these substitute forms of credit can be quite fragile, and a source of systemic risk. Consider specifically collateral transformation trades. These are structured as repurchase transactions, typically with lower-quality collateral, to raise funds for CCP IM: a borrower pledges low-quality securities not eligible at CCPs as collateral for a loan of cash or higher-quality securities that are CCP-eligible. The borrower's collateral is subject to a "haircut": the value of the securities pledged exceeds the value of cash or other securities received in return. This haircut is negotiated between the borrower and lender, and can vary over the term of the transaction, or be changed whenever the transaction is rolled over.

This is highly problematic, given that the repo market was at the vortex of the Crisis. In particular, haircuts—margins—on low quality collateral rose dramatically during the crisis. This required affect participants to raise additional funds or de-lever, thereby exacerbating the vicious funding cycle and leading to fire sales of assets to raise funds. [4]

In the words of Gorton and Metrick (2012) there was a "run on repo." (See also Martin, Skeie, and von Thadden, 2010). There were also fears that the systemically important tri-party repo market would freeze or that the bankruptcy of

[4] As another example, MF Global's demise was precipitated by rising haircuts on "repo to maturity" transactions involving peripheral European sovereign debt (e.g., Greek and Spanish government bonds).

repo borrowers would lead to fire sales of collateral (Begalle *et al*, 2013; Antinolfi *et al*, 2012).

Thus, collateral and clearing mandates may throw us out of the systemic risk frying pan and into the systemic risk fire. They will almost certainly lead to a substitution of one form of credit (e.g., credit lines, repo of low-quality securities) for another (the credit embedded in uncollateralized derivatives). The net effect of clearing mandates on the credit risk in the system, or the fragility of the credit in the system, is again uncertain. What is certain is that focusing only on the impact of mandated clearing on the amount of credit risk in derivatives trades vastly overstates their effect on the amount of credit in the financial system as a whole. Again, such an analysis is profoundly un-systemic, and hence an unreliable basis for conclusions regarding the effects of clearing on systemic risk.

D. CCP Collateralization Mechanisms Create Potentially Destabilizing Feedbacks

CCP initial margin and variation margin mechanisms can both contribute to destabilizing feedback mechanisms. Particularly during times of financial stress, the variation margin mechanism can be highly destabilizing. This is true of margining generally, but the rigidity of CCP margining makes it particularly dangerous: the CCP variation margining mechanism, operating on a very rigid time scale, creates a form of tight coupling that can lead to chaotic feedbacks.

With IM, the greatest systemic risk arises from "procyclicality." CCPs that set IM based on achieving a given probability (e.g., 99.7 percent) that margin will exceed losses over a liquidation period increase margins when volatility (or other factors that affect price risk, such as correlations) increases. This can set off a

destabilizing feedback mechanism (Brunnermeir and Pedersen, 2009). Because margin is costly, increases in margin induce some market participants to reduce their positions: these position reductions can occur not just in the instruments experiencing higher margins, but in other positions as well. These position reductions tend to exacerbate the initial price movement that spurred the CCP to raise margins in the first place. This tends to increase the measure of volatility that the CCP uses to set margins, which can lead to yet further increases in margins.

Moreover, the fact that market participants may adjust other positions in response to a CCP's increase in margins on given instruments, a margin increase in one market may have spillover effects on prices in other markets, which can affect margins in those markets, leading to another round of feedback effects. These "fire sale" effects are most acute in situations when markets are already stressed, as market and funding liquidity tends to be low during such periods. Lower market liquidity tends to exacerbate the price impact of position changes induced by margin changes, and reduced funding liquidity tends to increase the position adjustments that result from an increase in margins because under such circumstances it is more expensive to fund the higher IM.

Variation margin payments also tend to create vicious feedbacks, especially in stressed market conditions. Systemic crises are associated with huge price movements: the 1987 Crash involved a 20 standard deviation move in the stock market, and 25 standard deviation price movements occurred in some markets during the 2008 Financial Crisis. Such price movements lead to huge variation margin calls that must be funded either by the sale of assets, or borrowing.

Large movements in the prices of instruments that are marked-to-market and subject to variation margining necessitate large payments by those whose positions have declined in value. In a cleared market, these payments must be made within a very short time window, measured in hours at most. Failure to make a margin call puts the offending party in default to the CCP. If the missed margin payment is sufficiently large, the CCP may be unable to meet its obligations to those with winning positions. This would put the CCP itself into default, with potentially catastrophic consequences for market stability.

These payments must be made in cash, meaning that the clearing system requires that participants have access to liquidity. It is conventional for clearing firms to have credit lines with settlement banks that they can draw on to make variation margin payments. It is also conventional for clearing members to fund margin calls for their customers. Indeed, the operation of the margining mechanism relies heavily on the extension of credit (Bernanke, 1990).

Large price movements result in large variation margin flows that can exceed credit lines by a large amount. Moreover, these large price movements can call into question the solvency of market participants. This can lead clearing members to hesitate to extend credit to their clients, and can cause banks to hesitate to extend credit to clearing firms, and perhaps even to pull credit lines. Thus, there is a material risk that insufficient credit will be extended to permit prompt payment of variation margin during periods of large price movements. This can call into question the CCP's ability to meet its obligations.

Merely the fear of such a development can have adverse effects. For instance, those with winning positions who doubt their clearing members' solvency (or ability to obtain credit) may attempt to liquidate positions and pull funds from clearing firms. Those who fear the CCP's ability to meet its commitments may liquidate positions. These liquidations of positions may exacerbate price volatility, and result in declines in trading market liquidity (i.e., wider spreads and lower market depth).

Actual failures to make variation margin payments (which can result from the insolvency of traders, or the inability of solvent traders to secure credit) can be extremely detrimental. Defaulters' positions must be hedged and replaced, which can tax trading market liquidity and exacerbate price movements. Even if losing traders do not default, they may so stretch their credit that they must liquidate positions to reduce their exposure to future losses, or liquidate other assets to maintain losing positions. These liquidations can exacerbate price movements and spark a vicious feedback loop.

Furthermore, defaulters' collateral must be liquidated, which can also cause movements in the prices of the assets used as collateral and related assets, resulting in further knock-on effects. [5] These effects are more acute, the less liquid are the markets for the defaulted instruments and the assets used as collateral. This means that the mandated extension of clearing to less liquid instruments, and the reliance on less liquid forms of collateral to meet mandated requirements, can increase the vulnerability of the markets to these adverse effects.

[5] The potential for firesales of defaulters' collateral by CCP could justify the provision of central bank liquidity support to CCPs.

CCPs typically arrange credit lines with banks to meet their obligations to make margin payments in the event of a default, thereby reducing the need to liquidate collateral. However, there is a risk that the bank that extends the credit line will be the defaulter, or in financial distress: this "wrong way" risk is potentially acute because the CCP is likely to need such liquidity support precisely during periods of extreme financial market stress, which is also when large financial institutions that provide the liquidity lines are themselves stressed. There is also the risk that the bank will attempt to avoid performing on the line due to concerns about the solvency of the CCP.

These are more than theoretical possibilities. An old but instructive illustration is the failure of the Gold Clearing Bank on Black Friday in 1869. A more recent black day—Black Monday, 1987—provides an example of a very close brush with disaster.

The stock market crash (and bond market boom) that occurred on 19 October, 1987 resulted in immense variation margin payments. On Black Monday, there were $2.0 billion in intraday margin calls on the CME alone, and another $1 billion from the Options Clearing Corporation (OCC). In addition, the margin calls for Tuesday morning totaled $3.0 billion between the CME and OCC. These sums were far larger than variation margin flows on a typical day, which were on the order of $120 million for the CME (Tamarkin, 1993; Brady Report, 1988).

Banks' concerns about the creditworthiness of their clearing member customers resulted in the pulling of some uncommitted credit lines and restrictions on new credit to clearing firms (Brady Report, 1988). In one particularly harrowing

incident, one firm that owed the CME clearinghouse $207 million missed the 7AM deadline for making its margin call, and its settlement bank refused to permit an overdraft on the firm's account. CME executives made a personal appeal to convince the firm's chairman of the gravity of the situation, and shortly thereafter it made the payment. But the CME was late in making some margin payments, and the delay sparked rumors that the CME clearinghouse would fail, which contributed to a further sharp selloff in the stock and stock index futures markets (Brady Report, 1988).

As things worked out, disaster was averted. This was in large part due to the intervention of the Federal Reserve, which made strong public statements affirming its commitment to provide liquidity to the market. In addition, the Fed gave permission for Continental Bank to extend credit to its option trading subsidiary First Options when the latter was at risk of default (Bernanke, 1990). The Federal Reserve Banks of New York and Chicago encouraged their member banks to extend credit. In response, money center banks lent extensively to securities dealers and futures clearing firms (Carlson, 2007).

Clearing mandates increase the potential for such acute stresses on funding liquidity during periods of extreme market volatility. Moreover, the extension of clearing to less liquid, more difficult to price products, and the utilization of riskier, less liquid, and more difficult to manage forms of collateral increases the potential for a credit market seizure. Clearing mandates make both of these changes substantially more likely.

This is not to say that that these effects cannot occur in traditional bilateral markets: they most certainly can, and have. However, the vast expansion of the derivatives positions that are subject to the rigid discipline of variation margining on tight, rigid time schedules that results from clearing mandates increases dependence on short term credit/liquidity supply mechanisms, and hence the vulnerability of the financial system to such catastrophes.

In centrally cleared markets, intra-day margin calls must typically be met within an hour, and end-of-day margin calls early the next morning. A firm's failure to make a margin call puts it into default, and this default may make it impossible for the CCP to meet its obligations to those owed variation margin payments, thereby putting the CCP into default. Indeed, even fears or rumors that the CCP will be unable to make margin payments due to the failure to receive margin payments from those suffering mark-to-market losses can result in runs on the CCP.

The necessity of meeting margin calls on a tight schedule also makes the system vulnerable to operational problems. The failure of Fedwire during the Crash of 1987 is one example of a potentially disastrous glitch (Bernanke, 1990); a mistaken margin call of more than double the true amount on that date was another (Tamarkin, 1993).

These malfunctions can have catastrophic effects in a tightly coupled system like a financial market. In such a system, failures can propagate explosively and unpredictably (Bookstaber, 2007). For instance, the failure of a firm to meet a margin call due to an operational problem can lead to the distress, and perhaps failure, of other firms that are connected *via* the margining mechanism because this

system in a cleared market is dependent on the rapid and timely performance of all interconnected participants.

Remarkably, a recent BIS study minimizes the importance of variation margin: "variation margin payments . . . should not have a first-order effect on the demand for collateral, as variation margin I a one-way payment and hence does not affect the *net* demand for collateral assets" (BIS, 2013; emphasis in original). The experience of Black Monday, and other historical episodes, demonstrates that the *net* demand is not particularly germane: the *gross* demand for liquidity to meet margin calls matters. Variation margin payments must be funded, and there are frictions that impede the costless recycling of variation margin payments even though they are zero-sum by nature. Indeed, what would be the point of variation margin in the first place if those receiving it were willing to extend credit to those paying it regardless of market conditions? Variation margin exists precisely because market participants choose to limit the amount of credit they provide to their counterparties. Particularly during periods of market stress, variation margin obligations affect the demand for liquidity (either in the form of cash, or liquid securities that are margin-eligible). These demands are clearly of "first-order" during market breaks.

In other words, increased collateralization frequently makes microprudential sense, but it can have adverse macroprudential consequences, particularly during periods of market stress, and particularly when the collateralization mechanism is rigid, and operates on a precise time schedule, as is the case with CCPs. Margining mechanisms redistribute counterparty credit risk, and not necessarily to those best

able to bear it. Moreover, these mechanisms can generate feedbacks that can be highly destabilizing.

E. Loser Pays and Wrong Way Risk: CCPs as CDOs (or Monoline Insurers)

The CCP "loser pays" model creates a "default waterfall" in which it is expected that initial margin will cover all losses on defaulted positions. In the event that margins are insufficient to cover losses on a defaulter's positions, losses are mutualized among the CCP's members, typically through a default fund. For instance, if a defaulter posts 100 in margins, but losses on its positions total 150, the remaining loss of 50 is borne the default fund, which is funded by contributions from the CCP member firms.[6] If the default loss is larger than the default fund, many CCPs have the ability to assess members for additional contributions to the fund (typically in an amount equal to their initial contribution. If the default loss exceeds the default fund plus any additional assessments plus the CCP's equity, the CCP defaults.

The larger initial margins, the less likely it is that losses will hit a CCP default fund. Indeed, if the loser almost always pays, the default fund (and hence the members who contribute to it) incurs losses only under extraordinary conditions. This may seem desirable, but it creates a particularly pernicious form of risk: wrong way risk.

In particular, the default fund of a CCP is most likely to bear large losses only in the event of the simultaneous or near simultaneous default of several member firms. Such an event is most likely to occur during a major market disturbance that

[6] The CCP's equity may also share in the loss, depending on the structure of the waterfall.

causes large price movements not just in cleared products but on other assets on the balance sheets of CCP members, including not just the defaulting members but non-defaulting ones as well. Thus, default fund contributors incur losses due to their exposures to that fund precisely when they can least afford them. Since members of major CCPs that contribute to the default fund are often SIFIs that will be financially stressed during a systemic event, the default fund exposure generates losses for large financial institutions precisely when they are most vulnerable. Moreover, since SIFIs are likely to be members of multiple CCPs, during a systemic event they are likely to suffer losses on default fund contributions at several CCPs simultaneously.

A big financial shock that is sufficient to cause movements in derivatives prices big enough to breach margin levels, and/or which damages a CCP member's balance sheet (or multiple members' balance sheets) severely enough to force it (them) into default is likely to be associated with severe financial difficulties at other CCP member firms. For instance, during the financial crisis all banks were suffering financial distress simultaneously and prices were moving dramatically; their stock prices all plunged together and their CDS spreads all spiked together. They were all exposed to the same big underlying risk—in the event, real estate prices. When those prices declined, all financial institutions were in distress, most of them in severe distress. The financial tumult also resulted in big moves in stock prices, interest rates, credit prices, and commodity prices—all of which could have and did create widening exposures on derivatives trades. Indeed, since CCPs have zero net positions, a big move in any price is going to create a big exposure for

the CCP.

And it is not just price movements that matter. Financial and economic shocks are also associated with large changes in volatilities that affect exposures on non-linear positions (notably options or contracts with embedded options). Moreover, high volatility makes it more likely that exposure values and creditworthiness will move substantially.

Liquidity effects of crises can also create dependencies. Market liquidity tends to decline during crises, which tends to increase volatilities, thereby exaggerating movements in exposures and creditworthiness. It also makes it more difficult to manage the risk on exposures, and to trade out of positions in order to reduce exposures. This means that when a CCP takes on a defaulter's positions under such market conditions, the default fund is at risk to greater losses.

Thus, in crisis periods, dependencies between the value of the backers of CCPs—the member firms (often banks)—and the exposures that CCPs are effectively writing protection against are highly likely to be of the wrong way variety.

This means that CCPs offer dubious protection against systemic risk. A huge economic shock, like that suffered in 2007-2008 creates dependencies that give rise to wrong way risks. They also give rise to big changes in exposures. The structures of CCPs have features that are particularly vulnerable to these dependencies. In this respect, they are similar to monoline insurers, which were similarly exposed to loss only under extreme market conditions, and which were effectively destroyed when these conditions occurred in 2007-2008.

Even if a CCP does not fail during a crisis, the wrong way risk problem means that the financial institutions that backstop it will have to make payouts at precisely the times that they are under strain. That is, CCPs load risk onto large financial institutions precisely during crises that are already stressing them.

This is not to say that CCPs cannot share garden-variety default risks more efficiently than bilateral arrangements. But that is not what the advocates of CCPs emphasize when arguing for clearing mandates. Instead, these advocates repeatedly and specifically hold them up as an antidote for crisis, as a bulwark against systemic risk.

The foregoing analysis of wrong way risk implies, however, that CCPs themselves are most vulnerable to default precisely at the time that their advocates look to them to be the breaks that contain financial firestorms. Consequently, any sense of security against financial contagion that they provide is very likely a tenuous one, and arguably a false one. Such complacency is particularly worrisome as it can undermine the urgency to find more effective and reliable measures to reduce the vulnerability of the financial system.

There is an analogy between CCPs and financial products that were deemed to be of low credit risk, but which performed very badly during the Crisis: senior (and supersenior) tranches of collateralized debt obligations (CDOs) and monoline insurers. AAA CDO tranches were deemed to be very secure because junior tranches absorbed default losses first, in the same way that margins are intended to absorb losses on defaulted derivatives positions. Credit rating agencies estimated that the probability that AAA tranches would incur losses were very small: that is

what justified the ratings, and resulted in these instruments trading at very low yields. Monoline insurers that wrote insurance on these tranches were highly rated for similar reasons: it was estimated that the likelihood of monolines having to pay out on this protection was very small.

But by the nature of these structures, the senior tranches suffer losses only in the event of an extreme adverse shock hitting near simultaneously many of the credits underlying the structure. Thus, these tranches are essentially "systemic risk insurance": the probability of loss is small, but losses occur precisely during systemic crises (Coval *et al*, 2008). Prior to the Crisis, this risk of CDOs was not reflected in ratings, and was likely substantially underpriced. Moreover, since many of these instruments were held by leveraged financial institutions that were stressed by the Crisis. Put differently, these structures insured some kinds of risk *via* diversification, but concentrated non-diversifiable risks: most notably, they concentrated the risk of a systemic shock that by definition cannot be diversified away.

CCP waterfalls are very similar to the waterfalls in CDO structures. Default funds are analogous to senior CDO tranches. As the Crisis showed, "systemic risk insurance" is highly flawed. Indeed, it is not insurance in the conventional sense at all, because it does not rely on risk pooling: the expression is an oxymoron. These flaws are particularly dangerous when the firms writing the insurance are large financial institutions. That is obviously the case with CCPs. That is, this "wrong way" risk problem can be a systemic crisis accelerant, rather than a firebreak: CCP default funds channel losses to large financial institutions precisely when they are

under financial stress. The experiences with AAA CDO tranches, and monoline insurers, provide a warning of the kinds of risks that CCPs incur, and of their limited utility as a way of mitigating systemic risk.

IV. Interconnections

It is often claimed that CCPs reduce the interconnectedness of the financial system because they replace a dense set of bilateral connections between pairs of firms with a smaller number of links between these firms and a small number of CCPs. This is often illustrated with diagrams like in Figures 1 and 2. Figure 1 is the densely interconnected OTC derivatives market, and Figure 2 depicts the cleared market, with fewer connections; no bilateral connections; and a hub-and-spoke configuration.

This sanguine conclusion is again based on an analysis that treats derivatives in isolation, and ignores how CCPs are embedded in the broader financial system. In terms of the figures, the transition from Figure 1 to Figure 2 is correct for derivatives alone, but it is not true for financial contracts generally.

Derivatives trades are not the only connections between firms generally, and particularly between financial firms. These firms engage in a wide variety of other transactions, notably secured and unsecured lending. Moreover, even if firms are not connected directly, they are connected indirectly. If bank A and bank B trade derivatives, owners of a money market mutual fund that buys A's corporate paper is connected to bank B, and risks arising from bank B's derivatives trades.

The analysis of netting and collateral, and their effects on priority, implies that even if clearing eliminates some bilateral derivatives contracts that connect

firms, it does not necessarily eliminate these non-derivative linkages, and moreover, affects, and generally increases, the counterparty credit risks in these other linkages. In the netting example given in section II, for instance, clearing increased the interconnection between B (the defaulter) and its non-derivatives claimants.

Furthermore, as discussed above, market participants will respond to the adoption of clearing by adjusting their financial contracting. These adjustments can involve the forging of new links between already connected firms, or the creation of new connections. For instance, collateral transformation trades, or other ways of borrowing to fund margins, that arise because of clearing mandates, create new connections between firms, and hence new potential channels of counterparty credit contagion.

The feedback effects from margining also serve to connect firms, though by a different channel than direct or even indirect counterparty credit risk exposure. As noted earlier, needs to fund increases in initial margins or variation margin calls can lead to fire sales of assets that have adverse impacts on any firms holding those assets, including those that have no direct or indirect counterparty exposure to those trading cleared derivatives.

Clearing also involves connections between firms. Even though some bilateral linkages between CCP members are eliminated when some transactions are moved to clearing, these members are still exposed to each other—connected to each other—through the default fund. And as noted in the discussion of wrong way risk, this exposure is greatest precisely under the conditions in which the member

firms are most likely to be facing severe financial strains. Furthermore, clients of CCP members are connected to these members.

In addition, CCPs can be connected. Although at present CCPs are not interoperable, meaning that they are not directly exposed to one another, they are indirectly exposed through a variety of channels. The most obvious channel is an overlapping membership: if CCP1's members incur a loss due to their exposure to its default fund, they may be unable to meet their obligations to CCP2's default fund if they are members of both clearinghouses.

CCPs are also connected by asset fire sale and liquidity channels. For instance, if CCP *J* must liquidate a large amount of a defaulter's collateral in a fire sale, and this depresses the value of collateral held by CCP *K*, this CCP's members (and their clients) may become undermargined, require *K* to make margin calls that can lead to other feedbacks like those discussed earlier.

In brief, a derivatives-centric analysis of the effects of the adoption of clearing on the interconnectedness of the financial system is highly misleading. The adoption of clearing almost certainly leads to adjustments in financial contracting that create new direct and indirect counterparty credit linkages between market participants, and at the same affects (and generally increases, through the priority effect) the amount of counterparty credit exposures on existing links. Moreover, clearing also affects the nature of connections between firms *via* other channels, namely the asset price channel (through fire sales) and the liquidity channel.

The financial system is extraordinarily complex. Existing models construct relatively simple networks of connections between firms, and focus on counterparty

credit channels. These models can provide some insights on some of the factors that affect the robustness and fragility of the financial network; they show that the stability of networks is highly dependent on their configurations and the kinds of shocks that they experience, but are far too rudimentary to provide meaningful guidance as to the effects of a profound change, such as mandated clearing. Moreover, these models tend to specify networks exogenously, or study random networks (Gai, 2013). We have no real understanding of what determines the equilibrium network configuration, especially in the presence of legacy contracts and relationship specific investments between market participants that affect the costs and benefits of adjusting to mandated changes in some contracting practices, including the mandated adoption of clearing. Given this profound ignorance, we should have no confidence in predictions about how the adoption of clearing will affect the interconnectedness of the financial system, or the robustness or fragility of those connections.

V. Incentives and Information

Relying on CCPs to reduce systemic risk places a very heavy burden on their managers and members to think and act systemically. There are serious doubts whether they have the incentives and information to do so.

To crystalize ideas, it is easiest to consider a not-for-profit CCP with members who mutualize risk: the analysis of for-profit CCPs with shareholders as well as members is even more complicated. These members can be expected to place their own interests foremost. Moreover, the preceding analysis shows that CCP decisions can redistribute wealth from derivatives counterparties to other

claimants of these firms, and claimants on their claimants, and on and on. This ability to redistribute means that the interests of CCP members are not aligned with the interests of market participants as a whole. Moreover, the earlier analysis also demonstrates that CCP decisions can have spillover effects, through, for instance, asset price and liquidity channels. CCP members will not internalize these effects.

This is most easily seen in decisions regarding initial margins. Consider the effect of an increase in market volatility. Such an increase in turn increases the risk of losses in the default fund, given the level of margins. Increasing margins reduces this risk, and is typically in the interest of CCP members because it redistributes wealth from other claimants of potential defaulters due to the effect of margins on priority in bankruptcy. Indeed, many CCPs implement largely mechanical methods (analogous to Value at Risk) that automatically require higher margins when volatility increases. Furthermore, these procyclical margin changes can trigger spillovers through asset price and liquidity channels, and CCP members will not internalize the costs of these externalities.

Thus, CCPs face imperfect, and arguably weak, incentives to manage systemic risk. Indeed, acting in the interests of their members, they can undertake actions that are actually detrimental to systemic stability. The metaphor of a levee is illuminating in this context.

The residents of one town along a river have every incentive to build up their levee to protect it from flooding. But the higher they build their levee, the more water spills over elsewhere. This is precisely why flood control efforts are typically and properly delegated to a central authority (such as the United States Corps of

Engineers) rather than left to the discretion of myriad local authorities: uncoordinated individual decisions likely results in levees that are too high overall, or to overtopping in some locations resulting from overly high levees in other places.

A CCP has an incentive to build up its levees—by raising margins during periods of financial distress, for instance—in order to protect its members against a financial deluge. But these actions redistribute the financial floodwaters elsewhere. Perhaps the gains from protecting the members of a CCP from the flood are greater than the losses inflicted on those who are inundated as a result. But perhaps not. The point is that the CCP does not take into account the losses inflicted on others into account. It is therefore not a reliable regulator of systemic risk, because it only represents the interests of a portion of the broader system.

Systemic risk fundamentally arises from coordination failures and externalities: entities take decisions that are individually rational but collectively inefficient. Individual CCPs represent only a subset of the participants in the financial system. They are therefore incapable of facilitating coordination of all participants in the system. Moreover, CCP actions inevitably create external effects through a variety of channels. CCPs are parts of the broader financial network, not the entire network: thus, although they might transform the nature of the network externalities that give rise to systemic risk, they do not eliminate them. Indeed, given the tight coupling in the financial network, self-preserving actions in one part of the network can lead to catastrophic chain reactions that destroy the entire network.

The nature of CCPs introduces other incentive effects that affect risk and systemic risk. In particular, CCPs do not typically vary margins or default fund contributions in a way that depends on the amount of risk that particular members bring to the clearing system.

The risk of default of a clearing member, and the loss conditional on default, depend on two factors: the cleared position, and the other risks on the balance sheets of the clearing member. The former can be called "position risk" and the latter "balance sheet risk."

It is well known that default risks on a particular position are essentially a compound option exposure: default losses on that position occur only if the position is out of the money, and the firm is insolvent. Solvency depends on the gains/losses on the position, and gains and losses elsewhere on the balance sheet. A CCP is therefore exposed not only to the risk associated with the position it clears for a clearing member, but the risk associated with the other assets and liabilities on the clearing member's balance sheet.

However, CCPs typically choose margins based strictly on the risk of the position a clearing member brings to the clearing system: they do not vary margins with the credit risk of the member (which depends on balance sheet risk), except perhaps in a crude—and problematic—way.[7] This has perverse incentive effects.

[7] Some CCPs base margin on credit rating. This can be highly destabilizing. A firm that suffers a ratings downgrade must post additional collateral, which can exacerbate the financial stress that produced the downgrade. This can lead to a vicious circle that can cause the failure of the firm. This dynamic occurred with Enron and AIG.

First, even if the CCP prices balance sheet risk correctly on average, it tends to underprice the risk of less creditworthy firms and overprice the risk of more creditworthy ones. This tends to distort the allocation of trading activity across clearing members: higher (lower) credit risk firms trade too much (little).

Second, the CCP's failure to price balance sheet risk implies that firms do not pay the full price of adding risk to their balance sheets: their margins do not change even if they add risk to their balance sheets. Thus, they have an incentive to become overly risky, by, for instance, increasing leverage or investing in riskier assets.

These moral hazards (distortion of the allocation of trading activity among members, and increasing riskiness of balance sheets) can contribute to systemic risk. Riskier firms trade more, and all firms have an incentive to increase risk. Since systemic risk posed by a clearinghouse is increasing in the risk the individual members bring to it, these effects tend to increase systemic risk.

These incentive problems are inherent in the CCP structure. A CCP that attempts to discriminate among members on the basis of margins or default fund contributions necessarily redistributes wealth among members: charging one member higher margins impairs that firm's competitive position *vis a vis* other members. Thus, members of such a CCP would have an incentive to importune it to lower their margins, and raise the margins of other members. These "influence activities" (Milgrom-Roberts, 1988) are wasteful, and CCPs can economize on these influence costs by eschewing any discrimination among members.

These severity of these incentive distortions depend on the heterogeneity of CCP membership: the more heterogeneous the membership, the greater the

distortion of a one-size-fits-all margin level. Some heterogeneity is inevitable, but it can also depend on policy choices: for instance, regulations that constrain the ability of CCPs to restrict membership based on financial criteria, such as capitalization, tend to increase heterogeneity and thereby exacerbate the moral hazards.

The foregoing suggests that CCPs face fundamental incentive problems that will prevent them from managing systemic risk in a discriminating way. Moreover, even if these incentive issues did not exist, and CCPs were benevolent institutions striving to act in the interest of the system as a whole, they do not possess the information necessary to make efficient decisions. CCPs know some things very well—the derivatives risks and exposures that they clear. They know how to manage these risks. They know far less about how their risk management decisions, such as raising margins, will affect other parts of the global financial system. It is therefore heroic to assume that they will be able to discern the systemically optimal course of action.

Those who claim that CCPs will reduce systemic risk universally fail to analyze the incentives they face, and the information they possess. CCPs are pieces of a broader system that observe a subset of systemically-relevant information. Their actions have external effects. Indeed, as large, interconnected, and important elements of the financial system, the external effects of CCP actions are greater than those caused by most other actors in the financial system. Thus, their incentives and information have important systemic consequences. Given this fact, failures to analyze CCP incentives and information render unreliable any assertions that CCPs will unambiguously reduce systemic risk.

VI. Summary and Conclusions

The Great Financial Crisis spurred a frantic search for institutional and structural changes that could prevent a future crisis, or at least reduce substantially the likelihood of a recurrence. Given that OTC derivatives were widely (but largely erroneously) blamed for the Crisis, this search focused on changes to OTC markets. From the very onset of the climax of the Crisis, governments seized upon mandatory clearing of OTC derivatives as the best way to reduce systemic risk arising from these markets.

This prescription was based on several beliefs about OTC derivatives markets, and how clearing would change them in a salutary way. Governments believed that clearing would reduce derivatives exposures through multilateral netting, and that such reductions would reduce risk in the system. They further believed that OTC derivatives transactions were excessively leveraged and posed substantial counterparty credit risks, and that rigid CCP margining would reduce (indeed, almost eliminate) these credit risks, and thus reduce the credit risk in the system. They also believed that large financial firms were too densely interconnected; that derivatives were an important source of interconnection; and that clearing would reduce this interconnectedness, further reducing systemic risk.

All of these beliefs are fundamentally mistaken. The irony is that although the mandating of clearing was (and is) intended to reduce systemic risk, to a very considerable degree the beliefs underpinning the mandates are profoundly un-systemic. They focus on derivatives in isolation, and ignore the fact that derivatives and CCPs that clear them are just a part of the broader financial system. When the

embeddedness of derivatives and CCPs in the system is explicitly introduced in the analysis, the case for the systemic risk-reducing effects of CCPs becomes very weak.

Derivatives-centric analyses overlook the redistributive effect of CCPs, and in particular of multilateral netting and collateral. Holding the set of financial contracts constant, these essential elements of central clearing redistribute credit risks in the financial system, rather than reduce or eliminate them. *A priori*, it is unknown and unknowable whether the risks will be redistributed in ways that reduce, increase, or leave unchanged systemic risk, or increase it in some scenarios and reduce it in others. Our ignorance of the systemic effects of this risk redistribution is compounded by the fact that the system will not stand still. Market participants will adjust other financial contracts and their pricing in response to a change in priorities induced by mandated central clearing. Given the incredible complexity of the financial system, and the myriad margins along which market participants can adjust, the risk of the new equilibrium system relative to the risk of the pre-mandate system is impossible to gauge. There will be unintended and unpredictable consequences with systemic implications.

These redistributive effects arise from the fact that firms are connected not just through derivatives, but through other financial contracts as well. These connections will remain after clearing mandates go into effect, and indeed, firms will adjust connections in response to the mandates. Thus, the belief that CCP mandates will *reduce* the interconnectedness of the financial system is chimerical. They will certainly *change* the topology of the financial network, but the effects of this change

on systemic risk are not obviously beneficial. In fact, these changes introduce new risks.

This conclusion is strengthened when one realizes that there exist what might be termed teleconnections between CCPs and entities in the financial system. Most notably, a CCP's initial margin changes and variation margin changes can have far reaching effects on firms not directly connected to the CCP. For instance, large variation margin flows can lead to increases in the demand for credit that impact the rates paid by all borrowers, not just those needing to finance variation margin payments. Similarly, firms may sell assets to raise cash to make variation margin payments. These sales can affect prices, and hence the wealth of other market participants in ways that induce them to take actions that contribute to the instability of the financial system.

It is essential to recognize, moreover, that CCPs have weak incentives and insufficient information to take these teleconnections into account when making decisions that have systemic consequences. They have every incentive to act in the interests of their members, and in particular, to shift losses and risks away from their members to the broader financial system.

In sum, the existing intellectual case for mandated clearing as a palliative for systemic risk is fundamentally flawed because it fails to take a truly systemic perspective. The arguments supporting this case tend to treat derivatives and the CCPs that clear them in isolation. But CCPs and derivatives markets are anything but isolated from the financial system. They are vitally important components of it. When one considers the rich set of interactions between clearinghouses and the

broader financial system, it is quite evident that they have been oversold as a way of reducing systemic risk.

Once this is understood, it becomes obvious that clearing is not a fire-and-forget institutional and structural fix to systemic risk. Macroprudential regulators must understand, and be prepared for, the systemic consequences of CCP policies and actions, especially during periods of crisis. Four regulatory issues stand out.

The first is the procyclicality of initial margin. Procyclicality is easy to identify, but hard to mitigate. But at the very least, regulators should avoid prescribing margin setting methodologies that require procyclicality, as the CFTC did in its Risk Management Requirements for Central Counterparties (CFTC, 2011).

Second, CCPs can pose substantial strains on funding liquidity markets, particular during periods of high volatility and market stress. Monetary authorities must be prepared to manage these liquidity shocks, either directly (by lending to CCPs) or indirectly (by lending to those who need to finance variation margin payments, or to those who lend to those who need to finance variation margin payments). (See Bernanke, 1990 for a justification of such policies.)

Third, in order to ensure that market participants internalize the true costs of central clearing, capital charges for default fund exposures to CCPs should reflect the wrong way risks that are inherent in their waterfall structures. Failure to do so will incentivize the accumulation of excessively large positions backed by insufficient default fund capital.

The fourth issue is a general one: regulators must be aware of the levee effect. That is, they must not focus on building up the strength of CCP levees without

considering how these measures will potentially cause costly spillovers elsewhere. Indeed, it would be cold comfort indeed if CCPs were made immune to failure, but this resulted in spillovers that wreaked massive havoc elsewhere in the financial system.

This list could be expanded substantially, but these issues are of first-order importance. But the most important thing of all is to understand CCPs as they are, as important components of the broader financial system. To reduce the likelihood that CCPs will be the source of systemic risk, it is essential to understand how events in the financial system affect CCPs, and how CCP actions affect the broader system. This paper is an early attempt to trace out these interactions, but it must be recognized that many of the effects of clearing mandates will be unintended and unexpected. Future research—and regulatory vigilance—will be required to understand, and to respond to, these effects.

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Figure 1

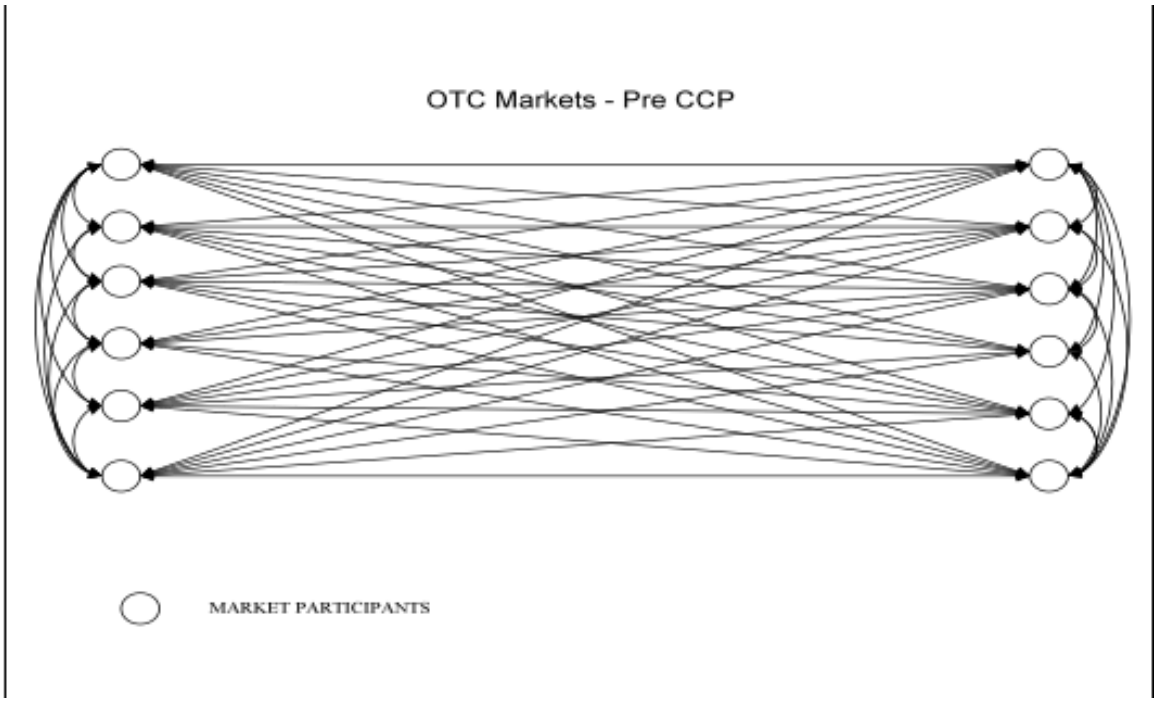
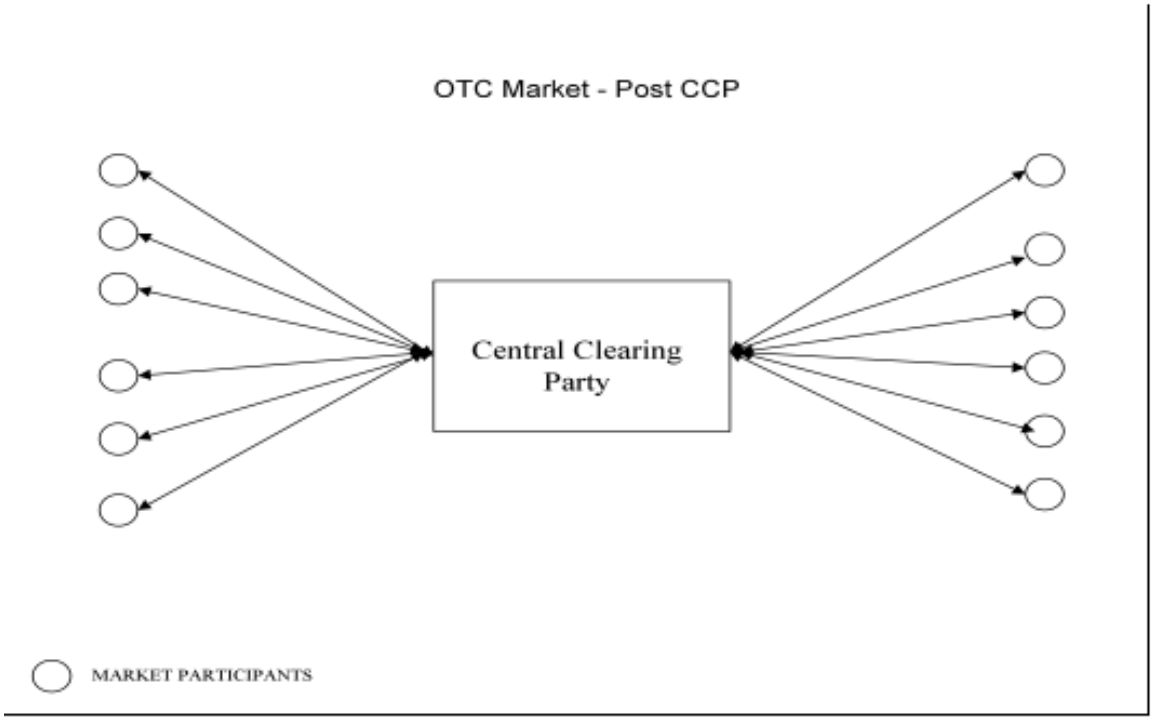


Figure 2


OTC Market - Post CCP
Central Clearing Party
MARKET PARTICIPANTS