CENTER FOR RISK MANAGEMENT RESEARCH

Working Paper # 2013- 11

<u>Centralized Clearing for Over- the- Counter Derivatives</u>

Gordon Rausser, University of California at Berkeley
William Balson, OTC Online, L.L.C.
Reid Stevens, University of California at Berkeley

University of California
Berkeley

Centralized Clearing for Over-the-Counter Derivatives

Gordon Rausser*, William Balson**, and Reid Stevens***

Abstract

Systemic risk propagated through over-the-counter (OTC) derivatives can best be managed by a public-private central counterparty clearing house (CCP). Though private CCPs provide an adequate amount of clearing's private good, they do not provide the socially optimal level of the public good or impure goods. By undersupplying both public and impure goods, private CCPs may exacerbate the conditions under which financial crises develop and propagate. A public-private partnership could align incentives so that the CCP produces the socially optimal level of the private, public, and impure goods. We propose using an RFQ platform with an active transaction permissioning system that uses position risk based on Monte Carlo simulation to estimate default risk and a two-part pricing scheme to efficiently price the risk retained by the clearing function. This structure, in contrast to current proposed government regulations, would price the clearing risk of OTC derivative instruments according to their financial risk rather than according to a qualitative classification of "good" versus "bad" contracts.

* Robert Gordon Sproul Distinguished Professor, University of California, Berkeley. Rausser@berkeley.edu

** Ph.D., Managing Director of OTC Online, L.L.C. Wbalson@pacbell.net

*** Ph.D. Student, University of California, Berkeley. Reidstevens@berkeley.edu

1. Introduction

Over the course of the most recent financial crisis, the government lacked regulatory mechanisms to deal with firms whose failure could trigger the failure of other firms through the over-the-counter (OTC) derivatives market and was forced to manage the systemic risk posed by large financial institutions on an *ad hoc* and *ex post* basis. To prevent cascading defaults, the government facilitated the sale of some large financial institutions (e.g. Bear Stearns), allowed others to declare bankruptcy (e.g., Lehman Brothers), and injected capital into many through the Troubled Asset Relief Program (TARP) (e.g., Bank of America). Even the treatment of firms that struggled after receiving payments through TARP was unpredictable; Citigroup and AIG received additional support through direct public investment while CIT received no further assistance beyond the initial support of $2.33 billion. The *ad hoc* nature of this process is unlikely to have been the most economically efficient choice except in the sense that urgency required action. These events have demonstrated the need to develop a clear regulatory framework to efficiently manage systemic risk whether posed by the OTC market or otherwise.

In this paper we propose that systemic risk be managed directly through the creation of a central counterparty clearing house (CCP). A CCP for OTC derivatives can be designed to decrease systemic risk by eliminating default risk between the counterparties to an OTC contract and by moderating the financial incentives to accumulate "excessive risk" in OTC markets.[1] The lack of such a CCP for OTC derivatives, particularly CDS's, has been labeled as a significant factor in the current financial crisis (Acharya *et al.*, 2009) and the OTC derivatives market, given its growth in recent years (Figure 1), will likely pose a larger threat to future systemic stability without a CCP.

1.1 Summary of Recent Legislative History

Both the Administration and Congress have proposed legislation to reform the OTC derivatives market. These proposals resulted in the Dodd-Frank Act of 2010. The Act encourages migration of OTC contracts to be cleared onto listed exchanges. Unfortunately, the Act leaves to each derivatives clearing organization (DCO) the decision of which contracts it will clear. As a result, the vast bulk of OTC derivatives are unlikely to be cleared by DCOs in the near future, making it likely that systemic risk will accumulate due to the bilateral credits risks of uncleared derivatives.

Several alternatives have been proposed prior to the Dodd-Frank Act. The Administration's proposal (Treasury, 2009) for financial regulatory reform expanded on commitments by the previous administration to establish a clearing house for OTC derivatives, focusing on promoting the public good by managing the systemic risk posed by OTC derivatives and promoting transparency in the OTC market. This proposal called for clearing "standardized OTC derivative transactions" and increasing "regulatory capital requirements" on non-standardized derivatives,[2] though it contained no detailed plans for accomplishing these objectives.

The House of Representatives had passed legislation that consolidated oversight,[3] required stronger capital cushions, regulated swaps, encouraged the use of a CCP, and increased the cost of capital on all counterparties. The Senate's Restoring American Financial Stability Act, which was proposed at the committee level, focused on increasing oversight of derivatives traders, not comprehensive clearing. As with the Administration's proposal, neither the House nor the Senate provided detailed plans to manage the systemic risk posed by the OTC market.

A very recent proposal (Volcker Rule) by the Administration aimed to prevent banks from using their deposits as collateral for their OTC trading by implementing the spirit of the repealed Glass-Steagall act, which prohibited depository institutions from operating in securities markets. The Dodd Frank Act contains a similar limitation.

In summary, a wide variety of legislative proposals have been advanced related to OTC derivatives clearing, but the final legislation only requires rule-making by CFTC and SEC to accomplish that objective. We believe one explanation for going slow is the lack of a detailed design for how a DCO could reliably clear the diversity of OTC derivatives. In this paper, we present such a design.

1.2 The Clearing Dilemma

The heart of the dilemma faced by policy makers in reforming the derivatives market is its size and complexity. As of June 2008, the notional value of all outstanding OTC financial contracts was in excess of $680 trillion, according to the Bank for International Settlements (2010) (Figure 1). In contrast, the value of all cleared derivatives traded by private regulated exchanges was below $20 trillion in notional value. Given the limitless variation among derivatives (i.e., underlying assets, terms and conditions, etc.) establishing capital requirements and clearing for this market has long been technologically infeasible. Only recently have technology and financial theory reached the point that centralized clearing for both vanilla and complex derivatives is possible.

Take in Figure (No. 1: 10-Year Growth of the Global OTC Market and Exchange Traded Derivatives Market)

We advance a proposal to (1) centrally clear not only standardized but also complex derivatives with real-time permissioning, (2) explicitly recognize the public-private partnership structure needed to effectively manage systemic risk, (3) implement efficient pricing of default risk and thus clearing, (4) allow structured finance to continue its pursuit of a world of more complete contracts (e.g. bonds and CDS's), (5) incorporate government policy instruments to allow the public sector to be compensated for controlling systemic risk over the business cycle. Instead of imposing excessive capital requirements suggested by some proposals, which would increase the cost of capital of trading such instruments, driving out the "good" with the "bad", our proposed framework will design a clearing solution that can accommodate all derivatives, but price the clearing according to their relative risk. This would allow traders to benefit from the "good" complex contracts, and, with centralized clearing, limit the systemic risk from the "bad" complex contracts.

2. Private Clearing

Private DCOs have recently begun clearing a subset of OTC derivatives that will expand as the CCPs develop methods to standardize some contracts and establish efficient margin requirements. The largest private initiatives are the clearing operations associated with IntercontinentalExchange (ICE), Chicago Mercantile Exchange (CME), Eurex, and Euronext. These financial institutions began clearing OTC derivatives in response to pressure from both the public and private sectors following the most recent financial crisis.

The clearing microstructure at these regulated exchanges is based on novation in which the DCO becomes the counterparty. (see Appendix 1). Novation eliminates bilateral counterparty risks but can cause the accumulation of financial risk in the DCO. Contracts are novated using a single-fee

for clearing along with initial and variation margin requirements. The relationship between margin determination and the volatility of underlyings is typically set by each exchange's committee of experts. Contracts are traded on a double sided auction (i.e. a separate order queue for bids and offers) in which the exchange determines set of tradable contracts with regulatory approval (e.g. CFTC).

Though each exchange has developed a platform that will efficiently facilitate transactions for standardized OTC contracts with liquid markets, they are not designed to provide complete public transparency or systemic risk management for the broader OTC market. The exchanges lack sufficient incentives to invest optimally in transparency and systemic risk management because the benefits of managing systemic risk generated cannot be appropriated by private CDOs. By only clearing standardized, liquid contracts (i.e., CDS indices and interest rate swaps), the public will only have price discovery on those segments of the OTC market, and the OTC market for complex, custom derivatives will likely remain opaque. The private DCOs also lack the capitalization necessary to remain solvent in the face of a financial crisis with cascading defaults in the OTC markets. Without adequate capitalization, the DCOs cannot economically manage systemic risk and will be forced to rely on government assistance in the event of a systemic crisis (despite legislative prohibitions on doing so). As a result, DCOs have become another potential source of systemic risk, particularly given the rapid consolidation that has taken place over the course of the last decade.[4]

3. The Need for a Public-Private Partnership

To correct the weaknesses of the private clearing initiatives, it is essential to understand the nature of goods generated through centralized clearing: transparency, systemic risk management,

and the facilitation of trades. The pure facilitation of liquid standardized trades is a private good, both rival and excludable. Transparency is a public good, both non-rival and non-excludable, the benefits of which cannot be entirely captured by a private DCO. The management of systemic risk is an impure good.[5] Systemic risk management is non-excludable because the contracts of all systemically important firms that default must be underwritten, either by the DCO or the government, but is rival because each defaulting firm requires a separate incremental investment. Private DCOs lack sufficient incentives to provide the socially optimal level of clearing's impure good.

3.1 Control Rights and PPPs

A public-private-partnership (PPP) can be formed to manage an OTC derivatives CCP to ensure the optimal level of the public, private, and impure goods are produced. A PPP could provide adequate capitalization and ensure transparency while maintaining incentives to facilitate trades through the assignment of control rights. The PPP literature has shown that ownership should be determined by the type of good produced and in the case of impure goods, joint management by the public and private sectors can be optimal (Grossman and Hart, 1986; Besley and Ghatak , 2001; Francesconi and Muthoo, 2006). Joint ownership, which is determined by the contractual assignment of control rights, can provide both sectors incentives to invest their resources and each sufficient control to ensure socially optimal levels of production (Rausser and Stevens, 2009).

A public-private OTC clearing partnership is inevitable, given the systemic importance of OTC clearing and historic public sector support for failing financial institutions to prevent cascading defaults.[6] If, during a financial crisis, a DCO becomes insolvent, the government will be

expected to act as lender of last resort. In the academic literature, models of private OTC clearing implicitly assume the government would bailout a DCO to prevent widespread default, though there is no formal public involvement or any compensation for the public sector to provide such services (Jones and Perignon, 2009).

If the partnership is explicitly recognized *ex ante* by forming a public-private CCP, the government can manage system risk over the business cycle by choosing to be compensated for the services it provides to stem systemic risk. If the partnership is designed *ex post*, the implicit insurance provided by the public sector will only be compensated on an *ad hoc* basis. But, the point of *ex ante* management is to moderate the forces that lead to excess in advance rather than *ex post*. Beyond compensating the government and strengthening their control over systemic risk, the creation of an explicit partnership clarifies the "rules of the game" for derivatives markets and reduces uncertainty over the government's role during a financial crisis.

4. Market Microstructure

To improve the provision of public and impure goods, we propose the public-private CCP use a request for quote (RFQ) platform along with the double-sided auction platform currently used by private CCPs. Most OTC trading is currently conducted as an informal RFQ auction in which telephone, fax, and electronic bulletin boards are used to disseminate interest on either the buy or sell side, and responses are made that may or may not see competing bids or offers. Our proposal is to systematize this informal process that already occurs.

4.1 RFQ Platform

The RFQ execution platform we propose has four principle advantages: (1) an RFQ platform allows traders to determine the set of complex contracts that will be traded and cleared by

combining standardized contract elements, (2) an RFQ platform promotes transparency by publishing price feeds for all traded complex contracts rather than just the standardized contracts, (3) an RFQ platform can stem systemic risk by facilitating clearing for any composite derivative, which would allow the government to require that virtually all derivatives be cleared, and (4) an RFQ platform's multi-party negotiations disseminate offer data to all market participants, reducing the informational asymmetry in the OTC market.

An RFQ market can coexist alongside existing double-sided auction markets and indeed is the only auction mechanism capable of expanding clearing to almost all OTC derivatives. In principle, double-sided auction markets are incapable of handling all complex OTC derivatives due to the exponentially large problem of combinatorics. For example, suppose an exchange lists and clears 10,000 names for standardized option contacts with 10 delivery dates and 10 strike prices. Then there are at least a trillion simple spread contracts with two legs. Clearly a double-sided auction would be unable to sustain such exponential growth. Fortunately, most transactions are focused on a small fraction of such possibilities, but still there are too many. We believe that any complex derivative composed of two or more standardized legs can reliably be cleared using an RFQ transaction facility with the proposed pre-trade permissioning.

The transaction process begins on an RFQ trading platform when a subscriber creates and posts the terms for a derivative contract. For example, if a subscriber chooses to create a calendar spread on an RFQ platform, they determine the underlying, strike price, class, quantity, and buy and sell expiration dates. Once posted, respondents offer quotes and sizes for the contract, which are aggregated and disseminated to all subscribers. Because the information processors for exchange traded options (i.e., Options Clearing Corporation and Options Price Reporting Authority) take complex option structures as individual legs for clearing and reporting purposes,

after a contract is agreed on at its net debit/credit price, users can negotiate the actual leg prices prior to final trade acceptance. At the end of a short RFQ period, subscribers can "Post to Block" for an RFQ they generated and move the request into the Block Trade facility to meet a second, pre-defined party and affect a cross between the best bid and offer prices[7] at the end of the associated RFQ period. While the parties finalize the terms of a contract, the CCP evaluates the contract's risk (Section 4.3—4.4) and sets the clearing fees (Section 4.5).

4.1.1 Liquidity

To function, a double-sided auction requires market makers who profit on the bid-ask spread, which is the spread between the price that clears buy orders and the price that clears sell orders. The bid-ask spread compensates the market makers for the costs of running its business as well as its retained risk (i.e. sometimes the flow of orders is imbalanced and the entity is expected to warehouse risk until the balance is restored). It is not always true that the bid-ask spread compensates for retained risk, especially in markets with few orders or in markets where the flow of orders is highly imbalanced for a protracted period. In those cases, the observed market response is typically that bid-ask spreads become very wide, liquidity dries up, and order flow eventually ceases. In extreme cases, bids to buy can be entered as so-called "stub quotes' and offers to sell can be entered at multiples of recent execution prices. The result is a failed auction market in which trading is impeded by the auction design.

Since there is no bid-ask spread in an RFQ platform, it is not possible for the market to collapse due to a lack of liquidity. In fact, the phone/fax methodology of the current OTC market adjusts well to periods of varying liquidity. We expect that the order flow will vary periodically and order executions would also vary. But market prices would still be based on the most recent

executions and quotes on the underlyings. Moreover, restarting an RFQ market can begin as soon as order flow begins to become balanced, unlike a double-sided auction in which the risk-reward relationship of a market maker must also be reflected in prices. Dysfunctional market prices, such as the flash crash, are less likely in an RFQ market: since, a buy and a sell order must be matched with no intermediary, the concept of stub quotes does not occur. However, during disruptive market periods there can be a time variation of executed transactions.

Even in illiquid markets an RFQ clearing platform can profitably clear contracts given the typical size of such contracts and the variable risk-based pricing component. Though we would not expect liquidity in all contracts, we anticipate that the market would respond to improved transparency of prices, which cannot be achieved on a double sided auction platform burdened with inadequate liquidity. Moreover, such transparency will decrease the informational advantage of financial institutions that have direct observation of order flows.

4.2 Clearing and Active Permissioning

An RFQ platform with clearing requires sub-second pre-trade permissioning to avoid impeding the flow of executions. Since OTC products can be composed of multiple underlyings, they can be decomposed into their elemental risks and the price feeds from the standardized components can be employed to determine mark-to-market value, even in illiquid markets. The decomposition procedure allows our approach to utilize price feeds for the elements of an OTC contract and compute the risk properties of an overall portfolio. OTC customized instruments can and are priced on a real-time basis, because multiple underlyings have mark-to-market forward price curves.

We propose combining an analytical value at risk (VaR) methodology with Monte Carlo simulation to implement real-time OTC contract permissioning.[8] With this approach portfolios of hundreds thousands of non-linear contracts, can be evaluated in sub-second time intervals. Even aggressive trading behavior can in principle be monitored in real time on a pre-execution basis without impeding the flow of negotiations in the OTC market. The key design tradeoff is the proper evaluation of functionality designed for speed (simplicity) and accuracy (complexity).

Risk can be accurately assessed with relatively time intensive Monte Carlo methods. Monte Carlo methods are the only accurate method of assessing financial risk in markets characterized by irregular probability distributions, rapidly changing volatility and correlation matrices, and highly non-linear payoff functions. Risk can be quickly approximated using analytic value at risk. Analytic value at risk methods allow for sub-second evaluation of risk for very large portfolios. Analytic methods are amendable to very rapid calculations and analytic approximations are available for almost all elemental derivatives.

Our essential insight is to use analytic methods as an extrapolation function that is calibrated to the Monte Carlo simulations. It is possible to relax any restrictions on mathematical form of the distribution of price changes by treating the analytic expression as an extrapolation function with appropriate modification enabling it to be periodically calibrated to the results of Monte Carlo simulations.

Take in Figure (No. 2: Active Permissioning Structure)

4.3 Measuring Value at Risk

Value at risk for a portfolio[9] is defined as a one-sided confidence interval on portfolio losses:

$$Probability(\Delta V_A, (T^{Var}, \Delta x) \geq -VaR_A) = 1 - \alpha \qquad (1)$$

where V_A is the value of a portfolio of deal elements of interest, T^{Var} is the risk horizon of interest, x is a vector of random state variables, VaR_A is the value at risk of portfolio A, and α is the level of confidence. This formulation is applicable to any portfolio, any set of state variables, and any process governing the stochastic evolution of the value of the portfolio. The portfolio may include deal elements that are securities, equities, bonds, options, futures, derivatives, or other assets. The state variables may be prices on deal elements, events that affect prices, external events, credit ratings, or other risk factors. The price process may be a named stochastic process or may have jumps, reversion, non-Markovian state evolution, stochastic volatility, discontinuities, or other features.

To use Monte Carlo simulation, VaR is rewritten as:

$$\int_{-\infty}^{VaR_A^*} Probability[(V_A(T^{Var}, x)]dx = 1 - \alpha \qquad (2)$$

where VaR_A^* denotes the result of calculating VaR using the most appropriate methods for that portfolio (typically a combination of simulation, decision tree, historical, or parametric methods).

For many portfolios of interest, accurate estimation of VaR_A^* requires very large Monte Carlo simulations and, when early exercise of options is considered, a stochastic dynamic programming approach. The advantage of Monte Carlo simulation is that it allows for an arbitrary level of accuracy depending on models and scenarios. The disadvantage of Monte Carlo simulation is that calculations typically take 6-24 hours, allowing for skewness, fat tails, etc.

The analytic delta-normal method can be used to rapidly approximate VaR, denoted by VaR', by restricting the distribution of V_A by assuming: V_A has derivatives with respect to each argument, the state variables are the prices of the deal elements, the periodic changes in value of V_A with respect to each argument are jointly normally distributed with mean zero. VaR' can be expressed as:

$$VaR' = -\left(\frac{dV_A}{dt}\right)T^{Var} + Z(\alpha)\sqrt{g^T \Sigma g} \qquad (3)$$

The advantage of analytical approximation is the speed of approximation: millions of portfolios can be calculated per second. This speed comes at the cost of accuracy since the set of solutions is restricted by assumptions on the distribution of V_A.

The analytical approximation of VaR can be calibrated on the simulated VaR to improve the approximation. This improved approximation is called position risk, PR_A', and may be written as:

$$PR_A'(T^{var}, \Delta x, \alpha, C) \qquad (4)$$

Where C are calibration variable inserted into VaR' to calculate PR_A'. Then these calibration variables are assigned values to minimize the difference

$$C = argmin_c\{|PR_A'(T^{var}, \Delta x, \alpha, C) - VaR_A^*(T_{var}, \Delta x, \alpha)|\} \qquad (5)$$

To support a rapid throughput of processing transactions the calibration variables are chosen with the viewpoint that VaR_A^* can generally be computed within a 24-hour period, while PR_A' is generally constrained to much tighter time limits. The calculation of PR_A' is performed in real-time position risk system, while calculation of VaR_A^* is performed by a simulation-based position

risk supervision system. The essential feature of the combined systems is that PR_A' is calculated in real time, while VaR_A^* is calculated periodically.

4.4 Two-Part Pricing

To price clearing services, it is first important to specify what quantity is exchanged in the clearing market and how that quantity is priced. The quantity exchanged is default risk which is calculated by our VaR method. There are many methods used to price default risk which share a common goal: the price of risk is set to compensate the CCP for the probability that a default occurs.

Currently, private CCPs charge a single fee for clearing with variation margin requirements. Given the high level of uncertainty regarding default risk at the outset of a contract, these CCPs typically overcharge for their clearing services. To most accurately compensate the CCP for the probability of default we propose using a two-part pricing schedule:

$$fee = a + b\ \chi(M, f, Z) \qquad (6)$$

where *a* is a fixed fee and *b* is the price of risk. The vector χ is the portfolio risk of the trader, which is based on the margin policy requirement, *M,* a vector of market price feeds, *f,* and a vector of contract positions, *Z*. This non-uniform pricing schedule is based on a simple two-part tariff (Tirole, 2004) composed of a fixed access fee, *a*, and a variable fee, *b*.[10] The functional form of $\chi(M, f, Z)$ is a many-to-one map isolating the forces that determine the quantity of risk. Appendix 2 contains a detailed example of two-part pricing.

Two-part pricing, which allows collateral or margins to be tailored to market conditions, is more efficient than a one part price with, or without, variable collateral requirements, under a variety

of assumptions because it allows for a risk sharing equilibrium. Efficient pricing is essential to adequately produce both the public and impure goods, since constrained pricing for clearing services necessarily generates an equilibrium off the efficient frontier. Over, or under, pricing of clearing services would lead to a sub-optimal amount of risk being borne by the CCP and would distort the prices of OTC contracts.

4.5 Exchange External Reporting

A critical microstructure design issue is the effect of offsetting positions on the determination of the price of risk. The CCP will only have a lens on the portfolio of contracts held on the PPP exchange. If large offsetting positions are held off the exchange and unknown to the CCP, the price of risk will be distorted. Systemically large firms might be required to report all of their capital structure continuously so the public clearing component could be based on full knowledge of the financial risks. As the price of risk for that portion of portfolio on the CCP platform for a particular counterparty begins to rise there will be incentives for that counterparty to post additional collateral and/or offsetting positions. This voluntary conduct will be in the self-interest of a transactor if their overall portfolio includes offsetting positions or hedged transactions.

5. Conclusion

The benefits of the past year's *ex post* and haphazard intervention have been concentrated among financial market participants who exploited the government's guarantee. The next cycle can only be more extreme as a consequence. A continued failure to allocate the costs and benefits of the implicit, *ad hoc* public guarantee could well continue to generate periodic catastrophic results. Regulations that inhibit financial innovation are not the answer, whether those regulations

restrict specific forms of contracts or restrict the allocation of economic rents among the producers of financial products.

A government-private partnership engaged in providing clearing services for OTC derivative markets is feasible and does not require a technology leap. We have argued here that one dimension of the technology leap is enabled by the technological innovation of real-time permissioning and novation or guaranteeing of OTC financial contracts. Equally necessary is the real-time monitoring by the centralized clearing organization during the negotiation of OTC financial contracts. This requires that all derivative exchanges and dealer networks be integrated into a cohesive uniform communication and permissioning network using existing software communication protocol routines.[11]

The motivation for our proposed public-private partnership is no less than the survival of the financially interdependent world that has been created over the last twenty years. Increasingly sophisticated financial market participants have learned how to maximize the value they extract from the implicit guarantees provided by the world's central banks or "lenders of last resort". In the most recent financial crisis, exercising that guarantee has pressed the financial capacity of the global economy to an extreme not previously witnessed even in the Great Depression. The benefits of the *ex post* and haphazard intervention have been concentrated among financial market participants who exploited the under priced guarantee creating a system that is fraught with moral hazard. The next cycle can only be more extreme as a consequence and a continued failure to allocate the costs and benefits of the implicit, *ad hoc* public guarantee could well continue to generate periodic catastrophic results.

Appendix 1. Novation vs. Guarantees

In the microstructure for the proposed public-private CCP, a critical question arises in regard to whether novation or a third party guarantee for contracts are provided in case of default. Novation has become the financial guarantee of choice in regulated contract markets (Williams, 2001). Novation means, literally, the remaking of the contract so that each original obligor (i.e., the parties to the derivatives contract) is entirely removed and is directly replaced by novator (i.e., the CCP). Though each party is replaced in the remade contract by the CCP, the contract has the same terms and conditions as the original contract. At the time of settlement or default, all enforcement and collection actions are taken directly against the novator and there are no direct transfers between counterparties. Because the CCP becomes a direct counterparty to each side of the trade, once novation occurs, the credit worthiness of the original counterparties is irrelevant to each trader as the traders only have a contractual obligation to the CCP. Novation completely isolates each party from the effects of a default by its counterparty, and indeed the counterparties may be anonymous.

Unlike novation, a guarantee is a contingent, secondary form of obligation that supplements, but does not replace, the original obligor. A CCP that only provides a third-party guarantee is only involved if one or more parties default. In case of default, demand must be made on the original obligator first, and that obligator must fail to perform before the CCP can be obligated to fulfill the contract. The CCP would typically only partially fulfill the contract and a haircut would be expected to be applied to the payments to each counterparty. A guarantee does not isolate the parties from the effects of a default by a counterparty, but it does cap the losses of each party.

An additional difference between novation and guarantees is the level of anonymity among traders. Novation allows for complete anonymity between trading parties and permits the CCP to set universal standards for determining credit worthiness. Since guarantees place much of the burden of determining creditworthiness on the trading parties, there can be no anonymity. Anonymity combined with an elimination of counterparty credit risk between buyers and sellers is largely responsible for the rapid growth in the volume of standardized financial contracts over the past 30 years. This growth has produced substantial benefits to the economy by making prices of financial products public information.

The choice between novation and guarantee determines the degree of active involvement by the public sector. A CCP that selects novation for all OTC transactions would require regular, direct involvement of the public sector in active management of the partnership. The partnership would determine the credit standards for participation in the OTC trades and the government would be compensated for all systemic risk insurance. If a CCP only provides guarantees for OTC derivatives the government would be involved when defaults exceed the CCP's capital.[12] Clearly, the PPP must make a determination of whether they will implement the microstructure for a novation or third-party guarantee process.

Appendix 2. An Illustrative Example of Two-Part Pricing

Consider an equity contract between two counterparties, *A* and *B*: party *A* believes large value caps will outperform growth and enters a $100 million contract that is long the Dow Jones Industrial index (DJI), long the Standard and Poor 500 index (OEX), and short the NASDAQ 100 index (NDX). Party *B*, believing growth will outperform large value caps, enters a $100

million contract that is short DJI, short OEX, and long NDX. Both parties post collateral of $50 million reflecting a 2:1 leverage ratio, with the remainder being a loan against the position. The duration of the contract is one year and the data used in this analysis covers March 25, 2007 to March 24, 2008.

Take in Figure (No. 3: Exponentially Weighted Volatility)

The daily volatility (exponentially weighted, $\lambda = .94$) of each index grew dramatically over the course of the contract (Figure 3). The variation in party A's position value was about +/- 10% over the period. The position risk for Party A, measured as the 99% 10-day VaR, grew approximately six-fold in response to the increasing daily volatility.

Take in Figure (No. 4: Position Risk)

Using a single-fee to price risk when facing such volatile risk (Figure 4) presents an insurmountable financial challenge: the CCP must either set a single fee, paid *ex ante,* to compensate for the variation in risk over the life of the contract, or require prohibitively large cash collateral as default risk varies. However, as the "lender of last resort" the government implicitly does guarantee at least some portion of such contracts, without receiving compensation.

Take in Figure (No. 5: Price of Risk)

Clearing this contract with a two-part fee is simple: the price of risk (Figure 5) increases as default risk increases. This price of risk can be calculated daily and applied to the value at risk for the transactors. It is true that by increasing the price of risk, the parties will likely find their

position less attractive economically and may choose to hedge or liquidate. But that is an economic decision and not constrained by inefficient pricing of risk.

References:

Acharya, V., Engle, R., Figlewski, S., Lynch, A. and Subahmanyam, M. (2009), "Centralized Clearing For Credit Derivatives", Acharya, V. and Richardson, M. (Eds.), *Restoring Financial Stability: How to Repair a Failed System*, John Wiley and Sons, New York, NY, pp. 251-268.

Bank for International Settlements (2010), "Semiannual Over-The-Counter (OTC) Derivatives Markets Statistics", available at: http://www.bis.org/statistics/derstats.htm (accessed August 21, 2010).

Besley, T. and Ghatak, M. (2001), "Government Versus Private Ownership of Public Goods", *Quarterly Journal of Economics*, Vol. 116 No. 4, pp.1343–72.

Department of the Treasury (2009), "Financial Regulatory Reform", available at http://www.financialstability.gov/docs/regs/FinalReport_web.pdf (accessed August 21, 2010).

Francesconi, M. and Muthoo, A. (2006), "Control rights in public-private partnerships," *IZA Discussion Papers* 2143, Institute for the Study of Labor (IZA).

Grossman, S. and Hart, O. (1986), "The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration," *Journal of Political Economics*, Vol. 94 No. 4, pp.691–719.

Jones, L. (2009), "Current Issues Affecting the OTC Derivatives Market and its Importance to London", available at:

http://www.bourse-consult.com/wp-content/uploads/OTCDerivativesReportv21.pdf (accessed August 21, 2010).

Jones, R. and Perignon, C. (2008), "Derivatives Clearing and Systemic Risk", paper presented at the Finance International Meeting AFFI – EUROFIDAI, December 2008, Paris, France, available at: http://ssrn.com/abstract=1095695 (accessed August 21, 2010).

Rausser, G. and Stevens, R. (2009), "Public-Private Partnerships: Goods and the Structure of Contracts", *Annual Review of Resource Economics*, Vol. 1 No. 1, pp. 75-98.

Tirole, J. (2004), *The Theory of Industrial Organization*, MIT Press, Cambridge, MA.

Williams, J. (2001), "Commodity Futures and Options", Gardner B. and Rausser G. (Eds.), *Handbook of Agricultural Economics*, North Holland, Amsterdam, The Netherlands, pp. 746-816.

Notes:

[1] This idea is not new: in 2004, Tim Geithner, then president of the Federal Reserve Bank of New York, warned the Federal Open Market Committee that the $5 trillion credit-default swap (CDS) market needed a CCP to control risk. At the time the idea of a CCP lacked support from the financial sector and derivatives continued to be traded without centralized clearing.

[2] Here we draw the usual distinction between standardized, or vanilla, OTC derivatives that have fixed terms and conditions and custom, or complex, OTC derivatives that have variable terms and conditions.

[3] A problem with the current regulatory environment is the existence of overlapping regulatory bodies, including Securities Exchange Commission, Commodity Futures Trading Commission, Federal Deposit Insurance Corporation, and the Federal Reserve.

[4] The systemic risk posed by consolidating clearing operations is discussed in Jones (2009).

[5] Impure goods are either non-rival or non-excludable but not both. These goods lie on the spectrum between public and private goods.

[6] The most recent bailouts of financial institutions are the last in a long line of government interventions (i.e., CBOT Silver, 1980; NYME Potatoes, 1976) that demonstrate its willingness to save private clearing firms have become "too big to fail".

[7] Best bid and offer prices are the best available ask prices, when buying contracts, and the best available bid prices, when selling contracts.

[8] The proposed methodology for evaluating risk has been extensively tested and validated by The Clearing Corporation (formerly the Board of Trade Clearing Corporation). Supporting documentation is available by request from the authors.

[9] The value at risk answers the question, "What is the most portfolio A can lose—with a $1 - \alpha$ level of confidence—over the next T^{Var} days?" For example, an overnight, 99% portfolio VaR of $1 million means that, under current conditions, 99% of the time, the daily loss in the portfolio will not exceed $1 million.

[10] The method we propose to quantify and price risk is quite common. Consider two-part risk pricing used in car insurance: risk is quantified using the purchaser's driving record and that risk

is priced to compensate the insurance company for its expected loss. The risk is regularly reevaluated and the price of risk changes in response to changes in the quantity of risk.

[11] FIX stands for the Financial Information Exchange Protocol, which is an industry supported standard for electronic communication of information about financial contracts. It was first developed in 1992, is currently in Version 5.0, and is supported by most large participants in financial markets.

[12] Jones and Perignon (2009) discuss the effects of a CCP that provides a guarantee with no explicit government involvement on systemic risk management.

Figures

Global OTC and Exchange Traded Derivatives Market

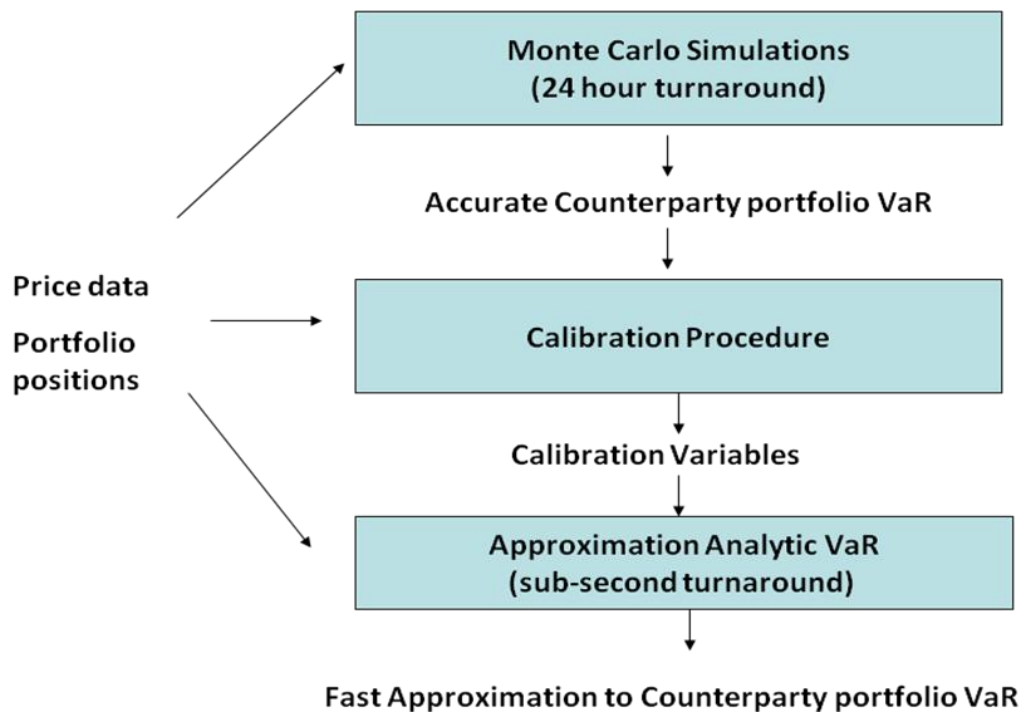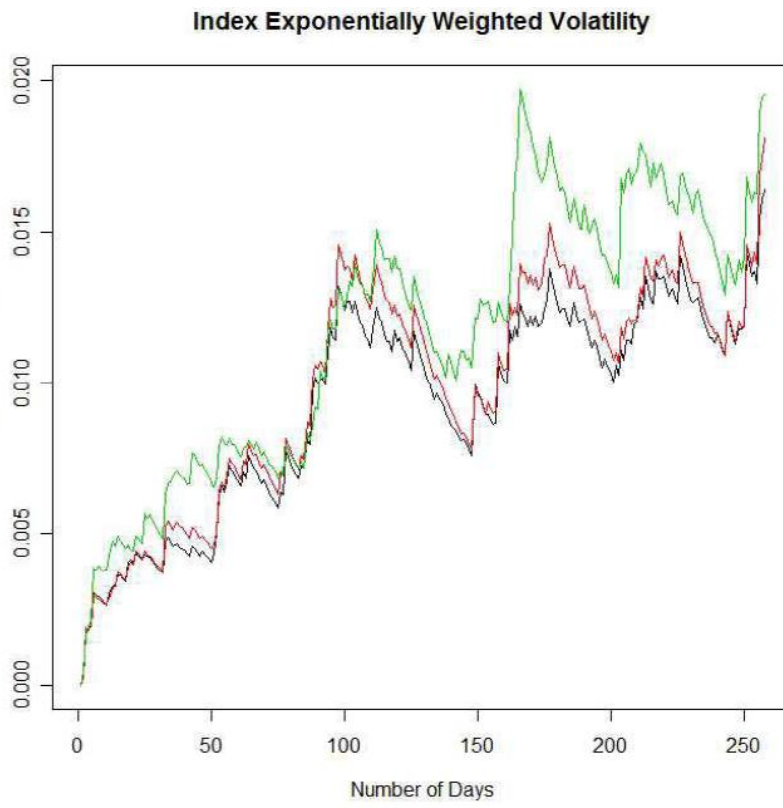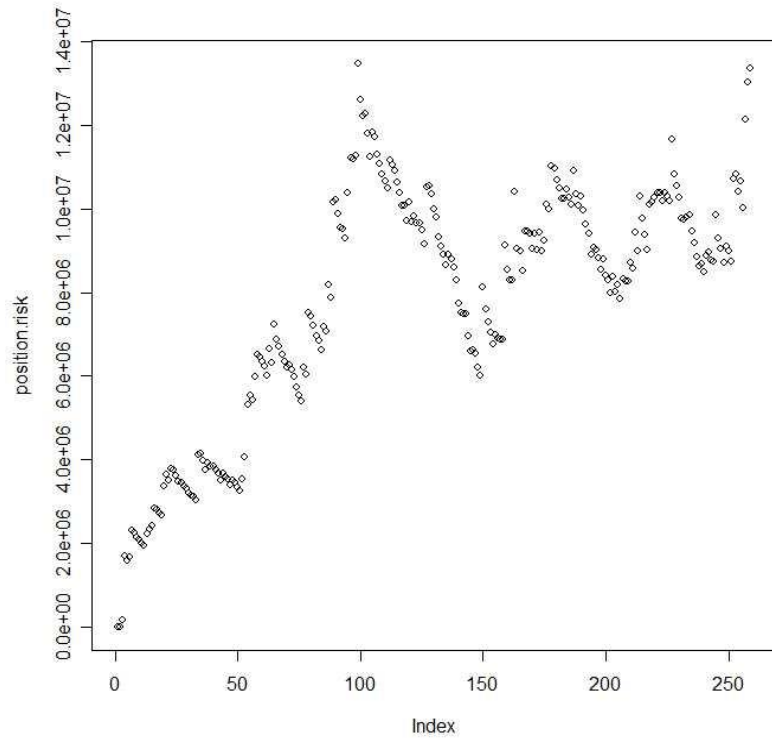Notional Value (billions of US dollars)
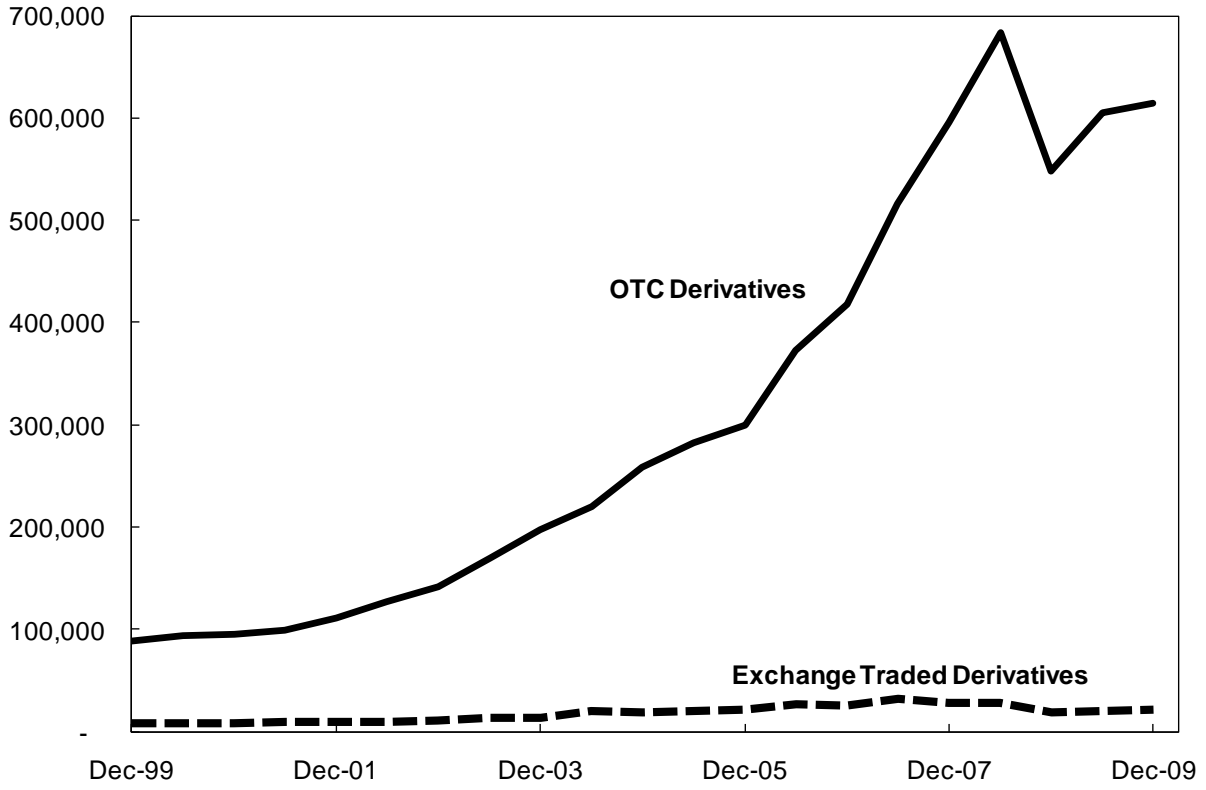
Figure i

Figure ii

Figure iii

Figure iv

Figure v