

**CAN THE FINANCIAL MARKETS PRIVATELY REGULATE RISK
IN PAYMENTS AND CLEARING SYSTEMS?**

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Abstract

This paper explores how organization and contract design has evolved to address regulatory challenges in risk management in payments and clearing systems. In the early part of the century, futures exchanges responded to credit risks by developing clearing houses that act as guarantors. The liability structure of the clearing house involves mutualization of risks through "partial permanent" integration of the exchange members. Bank clearing houses historically involved "contingent" integration and risk mutualization during panics. Recent organizational innovations have allowed the risk-control benefits of the clearing house to be replicated in the decentralized over-the-counter derivatives markets. Credit rating agencies and advances in risk modeling are key to permitting the recent "dis-integration," which has implications for the scope of public versus private regulation in banking and financial markets.

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Whether market forces would provide sufficient incentives to produce adequate self-regulation of financial institutions and markets is a hotly debated issue. This paper explores how innovations in organizational and contractual design and governance for financial institutions and markets have evolved privately to address regulatory challenges, particularly with respect to risk control and risk management. The specific focus is the origins and development of clearing houses at futures exchanges and the recent organizational innovations that have allowed the same risk-control benefits of an organized clearing house to be replicated in the rapidly growing and highly decentralized over-the-counter (OTC) derivatives markets.

I choose this focus for four reasons. First, the historical development of futures clearing houses and how they address issues of risk has been largely overlooked in the both the academic literature and the current policy debates.^{1[1]} Second, the recent contractual and organizational innovations in the OTC market and the role that credit rating agencies play in making feasible such new private institutions has received similar neglect.^{2[2]} Third, the relationship between development and performance of these institutions and the potential success or failure of private bank payments systems also has generally been overlooked.^{3[3]} Fourth, the evolution of the contracts and organizational forms in these financial markets during the last 150 years provides a rich example to investigate how private orderings address concerns about soundness and stability raised by public regulators.

The method here will be a comparative institutional analysis emphasizing organizational and contractual evolution in the spirit of the "new institutionalist economics" and

^{1[1]} Moser (1998), however, is a recent exception; Edwards (1984) is perhaps the first in the modern literature to acknowledge the special guarantee and regulation functions of the clearinghouse but did not emphasize their early evolution or the connection to bank payments systems.

^{2[2]} Remolona, Bassett, and Geonum (1996) is an exception here.

^{3[3]} Historical work on bank clearing and payments system is much more developed than that on futures markets. During the eighteenth and nineteenth centuries, many clearing systems emerged in European countries that had little or no financial regulation (Cowen and Kroszner 1989, 1990 and 1994). One of the earliest examples which has received some attention is the note exchange system that developed in Scotland during the 1760s (e.g., Munn 1975, White 1984, Cowen and Kroszner 1992, Kroszner 1997a). The development and operation of the Suffolk Banking System in New England during the mid-nineteenth century has received the most detailed scrutiny and there continues to be controversy as to what lessons to draw from the experience (e.g., Gorton 1985, Mullineaux 1987, Gorton and Mullineaux 1987, Cowen and Kroszner 1989, 1990 and 1994, Selgin and White 1994, Calomiris and Kahn 1996, Kroszner 1996, 1997a, and 1998a, Rolnick, Smith, and Weber 1998a, 1998b and 1998c).

"property rights" theories of the firm (e.g., Coase 1937, Demsetz 1969, Richardson 1972, North 1981, Williamson 1984, Alston, Eggersston, and North 1996, Masten 1996, Barzel 1997, and Kroszner and Rajan 1997; see Putterman and Kroszner 1996 for a summary). This study of the micro-institutions will compare and contrast the contractual and organizational approaches taken by individual firms, organized exchanges, and third-party monitors and how the competition among these forms affects the institutional developments in these markets. Understanding whether market forces have been able to foster creative and effective approaches to risk control ultimately can provide valuable guidance for improving global government financial regulation.^{4[4]}

The next section provides a brief history of risk-control features developed by the private markets in futures. A key theme is that many of the innovations in the clearing mechanism and the contracts have been motivated by an effort to control and manage risk, achieving outcomes desired by public regulators (Moser 1998). The second section will draw the analogy between the operations of derivatives clearing associations and bank payments systems, both historically and in contemporary times. The focus in both sections will be, first, on the standardization of the financial contract to enhance its liquidity and acceptability and, second, on the mutualization of risks that evolved through "partial permanent" integration of the members of a futures exchange through the liability structure of the clearinghouse and through the "contingent" integration of clearinghouse-member banks in times of financial panics. These organizational designs blur the traditional distinction between activities undertaken in a market versus those inside of a firm.

The third section will investigate in detail the modern OTC innovation of the Derivatives Products Company (DPC) that, I will argue, is a contractual and organizational form that attempts to reproduce the benefits of an exchange clearinghouse in a decentralized way. Improvements in risk management models and the development of credible third-party certifiers, such as credit rating agencies, allow the "dis-integration" of the clearinghouse structure without the loss of its credit control features. In addition, OTC contracts allow for more customization to fit particular demands of customers and so move away from the standardization achieved through the exchange-clearinghouse system. The paper thus traces the evolution of the futures markets towards centralization and mutualization of risk through exchange clearinghouses to the recent development of substitute organizational forms that have fostered the growth of customized contracts in the OTC market. Tentative lessons for the role of private regulation of the financial and payments system will be drawn in the final section.

1. ORIGINS OF THE FUTURES CONTRACT AND ORGANIZATIONAL STRUCTURE OF THE CLEARING ASSOCIATION

^{4[4]} Although understanding the political economy of financial regulation is paramount in the regulatory reform debate, that will not be discussed here (see, e.g., Kane 1984a, 1984b, 1987, Peltzman 1989, Romano 1997, Kroszner 1997b and 1998b, Kroszner and Stratmann 1998, and Kroszner and Strahan 1999).

From at least medieval times, forward contracts were common in Europe, particularly in international trade and finance (de Roover 1974 and Lane and Mueller 1985). Futures, which are essentially standardized forward contracts that could be easily traded, developed much later. The transformation from forwards to futures parallels the transformation from barter to money (Menger 1892, Telser and Higinbotham 1977, Cowen and Kroszner 1994). Two elements are key to the transition in the contract: the ability to transfer title to a commodity at low cost among numerous transactors and the grading or standardization of the commodity. A third important element concerns the institutional structure to support and foster the trading and enforcement of the contracts, namely the exchange and the clearing mechanism.

The first element arose in eighteenth England through the activities of the East India Company (Emery 1896, pp. 35-6). The Company issued "warrants," or warehouse receipts, for goods it was importing. Ownership of the underlying goods could then be transferred through the hand-to-hand exchange of the warrant. Many others adopted the practice, and trading in warrants developed. Initially, the warrants were for specific goods that were held at the warehouse in distinct compartments; in other words, the warrants were legal claims on particular lots of a good, not to an equivalent amount of the good of the same quality. Tradable receipts for grain stored in warehouses or grain elevators developed in Buffalo in the 1840s and soon after were introduced in Chicago (Williams 1982 and 1984 and Cronon 1991).

The second crucial step in the development of futures was a grading system which allowed for standardization of the contracts (Emery 1896, Hill 1990, Cronon 1991). Just as a system of weights and fineness was necessary for the use of precious metals as money, a system of grading of commodities was necessary to permit the interchangeability of the contracts (Telser and Higinbotham 1977). The warehouse receipts could then refer to a certain quantity of a particular grade of a commodity, e.g., 100 bushels of Chicago No. 2 spring wheat, and so could the futures contract. The futures could thus be settled by delivery of an appropriate warehouse receipt, thereby increasing the substitutability and tradeability of both the futures and the receipts.^{5[5]} As a contemporary scholar of the commodities markets concluded: "The development of the system of grading and of elevator receipts is the most important step in the history of the grain trade" (Emery 1896, p. 38).

In the U.S., the key force behind the development and enforcement of grading standards was the Chicago Board of Trade, which was founded in 1848, and went on to become one of the largest and most successful futures exchanges in the U.S. and the world (Taylor 1917 and Cronon 1991). The Board of Trade, however, was not formed with the initial purpose of becoming a futures exchange, but rather as a voluntary membership organization which operated as a chamber of commerce to promote general business interests in Chicago. The Board's earliest foray into standard-setting occurred in the early

^{5[5]} Note that loan contracts and bond contracts are a form of a futures contract in which the underlying "commodity" is money.

1850s when it tried to promulgate a standard definition of a bushel based on weight rather than the traditional but more difficult to verify volume-based definition. Its members could not agree on the appropriate weight (56 versus 60 pounds) and both standards were used until the mid-1850s.

The turning point in the Board's role as standard-setter came when, in 1856, it created three quality categories of wheat in the city and provided the criteria for the grading. Warehouse receipts quickly became "denominated" in the particular grade and did not refer to a particular lot. Adoption of the grading system permitted the fungibility of grains stored in the elevators and warehouses, thereby breaking the link between ownership rights and specific lots of physical commodity. This contractual innovation considerably improved the acceptability of the receipts^{6[6]} and provided the basis on which to construct a liquid futures contract. These changes "restructured Chicago's grain markets in way that would forever transform the grain trade of the world" (Cronon 1991, p. 116).

To make the grading system effective, the Board had to have a mechanism to encourage adherence to standards and new types of property rights they created (Lurie 1979). Initially, the main disciplining device was expulsion from the Board if a member was found to be not following or cheating on the classification system. Board membership had become valuable because grain trading throughout the city had become centralized in the meeting rooms of the Board and exclusion would have meant less timely access to pricing information and to potential transactors. In 1857, the Board members voted to appoint a "grain inspector" to police the grading standards used in the elevators and warehouses and gradually the number of inspectors grew. For a set fee, the inspectors would certify the quality of the grain for any receipt traded at the Board (Lurie 1979 and Cronon 1991). Their system of inspection and grading anticipated the rating systems that Moody's, Fitch, and Standard and Poor's developed a half century later to assess the quality of financial securities.

To resolve disagreements among members, the Board operated an arbitration committee to hear and decide the disputes. The Board's legal apparatus thus was much like the system of private judges and the self-generated Law Merchant that had arisen in the medieval trade fairs (Milgrom, North, and Weingast 1990) and the practices of the eleventh century Maghribi traders (Greif 1993). In 1859, the Illinois legislature formally recognized the authority of the Board committee to adjudicate disputes among members and enforce its grading and inspection rules on its members. The judgements of the Board committee were to be legally binding on members, equivalent to decisions rendered in the civil courts (Lurie 1979 and Cronon 1991).

^{6[6]} In fact, the acceptability of the grain receipts was sufficient that Chicago warehousemen of the 1860s effectively operated as fractional reserve bankers in grain, rather than gold, issuing "demand deposit" grain receipts and lending their grain long (see Williams 1984). The legal development of the negotiability of the warehouse receipts closely parallels that of goldsmiths' promissory notes in England (Williams 1984).

This self-regulatory system proved effective in increasing the value of membership and furthering the centralization of trading on the floor of the Board. Trading in futures, which had begun in the 1850s, expanded rapidly during the U.S. Civil War. Formal regulation of the futures contract by the Board did not arise until 1865 (Taylor 1917). In addition to standardizing the grain grades of contracts that could be traded on the exchange, the Board also standardized the delivery dates for the contracts. Standard contracts thus fostered the emergence of liquid markets in which traders could readily hedge so-called "market" risk, that is, the risk of price changes in the commodities and contracts.

These developments, however, did not address another important type of risk, namely "credit" risk that the counterparty to the transaction would fail. There was no formal clearing arrangement by the Board at this time, so contracts continued to be bilateral obligations between transactors. Each transactor thus had to try to evaluate the nonperformance risk of his counterparties.

Contracts could be settled by presentment of the physical grain or warehouse receipt on the delivery date. Alternatively, the contracting parties could agree to transfer cash to discharge the obligation. If this were done on the delivery date, the amount would be the difference in value between the price stipulated in the contract and the spot market price. The contract could be extinguished any time before the delivery date through a mutually-agreed-upon cash transfer. Combinations of offsetting futures positions and cash transfers between counterparties was typical, and the monetary payment was called the "offset" or "payment of difference."

Creating efficient ways to deal with the potential default on the contractual obligations is key to understanding the development of futures contract and organizational structure of the exchange (Moser 1998). Credit or nonperformance risk in futures contracts is particularly acute due to the potentially long time between entering the contract and the delivery date. Losses can accumulate over time. Also, a party in financial distress may have an incentive to increase risk-taking behavior, due to limited liability, possibly exacerbating losses. In a simple futures contract, counterparties have no recourse to prevent the cumulation of losses and risky behavior until the contract expires and legally actionable nonperformance occurs.

One informal response to the credit risk problem was for groups of traders to form "rings" in which they agreed to accept each others' contracts as substitutes (Baer, France, and Moser 1998). This practice enhanced the fungibility and liquidity of the contracts among group members and helped to reduce transactions costs since ring members could "net" their positions against the group rather than settling each contract individually (see Moser 1998 for details). The formation of such rings of trusted counterparties parallels formation of trusted groups of traders in medieval times who agreed to adhere to codes of business conduct (e.g., Greif 1993).

Organized futures exchanges also developed a number of formal rules to attempt to control credit risk for those who traded on the exchange, ultimately leading to the

mutualization of risk through a clearinghouse association (Taylor 1917, Williams 1986, and Moser 1998). First, as noted above, was the ability to bar from the trading floor parties who had defaulted on contracts. Second, the exchange could require that a member open its financial accounts to inspection if its solvency were questioned. In 1873, for example, the Chicago Board of Trade adopted a resolution that any member who refused to do so could be expelled (Andreas 1894). Third, the exchanges demanded that a margin, equal to a given percent of the value of the contract, be posted promptly as collateral or as a "good faith" deposit (Gay, Hunter, and Kolb 1986). A committee of the Board of Trade, for example, set the initial and variation margin requirements for contracts traded on the exchange and strict time limits for the posting of the margin; failure to post the appropriate margin would lead the exchange to consider the contract to be in default.

The next key step in the development of the futures market is the creation of the clearinghouse, which was founded by the Board in 1883 (Taylor 1917, Williams 1986, and Moser 1998). Initially, it provided no direct insurance function but simply was a means to reduce transactions costs of posting margins and settling contracts through "offset." In the first 14 weeks of its operation, for example, the *Chicago Tribune* reported that the clearinghouse processed 26,986 checks whereas, prior to the clearinghouse, roughly 260,000 checks would have changed hands to support the same amount of activity on the exchange (quoted in Moser 1998). With this more efficient system, the Board shortened the time allowed to respond to margin calls down to one hour in 1887. The reduction in transactions costs with the clearinghouse provided incentives to further centralize trading on the exchange and thereby further enhanced the value of exchange membership.^{7[7]}

While the measures discussed above did help to limit and make more homogeneous the credit risks involved in trading on the exchange, credit risk continued to vary with the individual counterparties or members of the trading "rings." This contract structure required each member to assess the creditworthiness of each counterparty and left contracts not completely fungible due to differences in credit risks. In addition, failure of one member could spread to other members, in parallel to concerns that the failure of one bank could cause losses at other banks and, perhaps, lead to a system-wide collapse (see Kaufman and Kroszner 1997). In 1902, for example, the bankruptcy of a George Phillips led to losses for more than 42 percent of members of the Board (Moser 1998). Following this episode, the clearinghouse at the Board gradually came to take a more prominent role in working out contract defaults but still did not interpose itself as a direct counterparty responsible for contract performance.

A number of European coffee and grain exchanges in the late nineteenth century had taken the next step in the development of the clearinghouse to make it effectively the

^{7[7]} Greater centralization can reduce competition that the exchange faces. On scale economies in trading futures contracts and rents earned by exchange members, see Pirrong (1998a).

counterparty in all transactions (Emery 1896). The *caisse de liquidation* and *Liquidationskasse* insured contracting parties on the exchange against default. These organizations would make full payment to the aggrieved party, collecting as much as possible from the defaulting party and drawing on an assessment fund to which members of the exchange had contributed. In 1891, the Minneapolis Grain Exchange appears to have been the first futures exchange in the U.S. to create a clearinghouse which provided this type of insurance role against nonperformance (Moser 1998). A number of other smaller U.S. exchanges adopted similar structures in the early part of the twentieth century.

Although there had been extensive discussions among the members of the Chicago Board of Trade about how to control default risk on the exchange, the Board of Trade Clearing Corporation (BOTCC), which became a counterparty to all transactions on the exchange, was founded only in 1925. Pirrong (1997) argues that the delay in adopting this structure came from financially strong members who were resistance to giving up the advantage of their high credit quality and implicitly subsidizing weaker members. There also may have been concerns about moral hazard given the difficulty of evaluating and monitoring creditworthiness in the late nineteenth and early twentieth centuries. Moody's-style credit rating systems, for example, became widely accepted only after WWI. The poor performance most state deposit insurance systems due to moral hazard problems during this period (see White 1983) also may have made exchange members wary of agreeing to a guarantee scheme.

With the creation of the BOTCC, members of the exchange were required to purchase shares in the clearinghouse, and only the member-shareholders were permitted to use the facility.^{8[8]} Members also were required to post their margin deposits with the facility. Eventually, this developed into two margin accounts: a proprietary account for trading related to trading for the member's own funds and a customer account which covers all of the trading activity of the member's clients. Part of the revenues from the clearing fees charged to members were kept in a reserve fund that could be drawn upon in case of a default. Although the BOTCC is separately incorporated from the exchange, the clearinghouse has the right to demand that its clearing members purchase additional shares.^{9[9]}

The BOTCC thus has three sources of funds to draw upon in case of a member's default: the proprietary margin of the defaulting member, the BOTCC's own capital (reserve fund), and the assessment of members for share purchase (see BIS 1997a). The BOTCC also maintains credit lines with banks. The clearinghouse thus becomes a credible high quality counterparty. The homogenization and limitation of credit risk thus improves the

^{8[8]} Two classes of membership have subsequently been created: clearing members, who must hold shares in the clearinghouse, and non-clearing members, who do not.

^{9[9]} See Rutz (1989) and BIS (1997a) for more details on the structure of the clearinghouse.

interchangeability of the contracts and liquidity of the market. In addition, this credit risk structure helps to reduce the likelihood of a failure of one party causing failures among others, thereby addressing public regulators' concerns about "system-wide" risk. Today, all derivatives exchanges have adopted some form of a clearinghouse as counterparty to reap these advantages (see Table 1).

These mechanisms have been extremely successful in risk control and management. Derivatives clearinghouses have weathered the Great Depression, the Second World War, failures of major players such as Barings, and high levels of volatility in the last decade without a collapse (Fenn and Kupiec 1993). In addition, the failure of clearing members has been rare during this time period. Competition between the different exchanges does not appear to have caused a race to the bottom, in terms of risk management and control, but if anything, a race to the top (Santos and Scheinkman 1998).^{10[10]}

The structure of the BOTCC represents a special organizational response to enhance liquidity and control risk. The BOTCC is a partial integration of members of the exchange into a single unit, since each is now at least in part financially responsible for the soundness of the others. The mutualization of risk entails a blurring of the distinction between member firms and the market. As guarantor of the contracts, the BOTCC has to be concerned about adverse selection and moral hazard and thus takes on a regulatory role (Edwards 1984 and Bernanke 1990). The clearinghouse acts like a headquarters of a rather loose holding company where each of the members is a subsidiary. While not having the same control rights that holding company would have over its subsidiaries, the clearinghouse can and does impose requirements concerning the liquidity, capital, and activities of its members.

The extent of the exercise of centralized control, hence the extent of the integration of the members, is contingent upon the state of the market. In times of financial distress, the integration becomes greater as the clearinghouse changes margin requirements, makes assessments on members, and uses mutually-owned reserves to settle failed contracts (or to restructure the terms of contracts). The existence of the clearinghouse thus creates an innovative structure that involves a variable degree of integration of the member firms over time. An alternative legal structure of the clearinghouse which also generates this partial and contingent integration is illustrated by the Chicago Mercantile Exchange (CME), which was founded in 1919 as a reorganization of the Chicago Eggs and Butter Board section of the Chicago Produce Exchange. Rather than being a separate corporation, the clearing mechanism that the CME eventually adopted is simply a division of the exchange, which is owned by its members. In the event of a default, the

^{10[10]} Competition among exchanges might lead the clearinghouses to adopt excessive risk protection, hence an inefficiently low level of default relative to the social optimum (Fenn and Kupiec 1993 and Santos and Scheinkman 1998). Since the focus of this paper is to assess the private incentives to reduce risk and the main public policy question focuses on the role of regulation in risk reduction, I will not try to evaluate whether the default rate on derivative exchanges is too low.

Clearing House can draw on surplus funds and margin deposits of defaulting members as well as other members. In addition, the clearing members of the exchange are mutually and severally liable for any unsatisfied default from the Clearing House (see BIS 1997a). Much as with BOTCC, this structure mutualizes risks and entails a form of state contingent integration of the various member firms into a single holding-company-like organization.

In sum, this brief examination of the development of the clearinghouse-as-counterparty in the futures markets illustrates the role of risk management and control in the evolution of the contracts and organizational structures. The next section examines similarities between the historical development of bank clearing associations and the futures clearinghouses just discussed. Particular emphasis will be given to the parallels in the contingent integration features of the bank clearing associations that allowed them to respond to system-wide risks.

2. RELATION BETWEEN DERIVATIVES CLEARINGHOUSES AND THE BANK PAYMENTS SYSTEM

As Edwards (1984, p. 226) points out, clearing associations in both banking and derivatives markets play an important role in facilitating the transfer of funds between transacting parties. He argues, however, that clearing organizations for banks differ from those for futures exchanges in three ways: "clearing associations in banking never become legal parties to transactions, do not act as guarantors in any way, and do not operate as a pervasive self-regulatory institution. Nor are they involved in facilitating settlement by delivery, which has no counterpart in banking."

While it is certainly correct that private bank clearing organizations do not fulfill any of these functions in contemporary times, bank clearing organizations historically did take on these roles, particularly before the founding of the Federal Reserve System. In addition, the Fed today operates Fedwire, the primary inter-bank payments system in the U.S., and has taken on these roles. I now turn to a description of how the Fed in modern times and bank clearing houses before the Fed operate in ways parallel to the ways futures clearing associations.

When the central bank is involved in the payments system, as represented by the Federal Reserve Board's operation of the Fedwire system in the U.S., the lender of last resort function and payments functions are closely associated (e.g., Gilbert 1998). Fedwire operates on a "gross" settlement basis. In other words, when a credit is made to an account on the Fedwire, the bank receiving the funds no longer has to worry about the creditworthiness of the party which sent the funds. This contrasts with a "net" settlement system, such as that on the privately operated Clearinghouse Interbank Payments System (CHIPS), in which actual funds are transferred only at the end of the day after transactions with counterparties are netted out. If a CHIPS member institution fails before the end of the day, for example, a counterparty may not be able to collect funds

that had been promised to it in CHIPS transactions.^{11[11]} On Fedwire, however, the Fed guarantees that the bank receiving the funds will have access to those funds regardless of what happens to the counterparty by the end of the day.

In this way, the Fed acts much like a clearinghouse on derivatives exchanges in that it effectively becomes the counterparty to all transactions on Fedwire and guarantees those transactions. The Fed acts as regulator, determining capital requirements, activities restrictions, etc., which permit eligibility for a bank charter and, hence, membership in Fedwire. Before the U.S. left the gold standard in the early 1930s, the Fed also facilitated settlement by delivery of specie.^{12[12]}

Before the founding of the Fed, important parallels also exist between banking and futures clearing associations. In both types of clearinghouses, periodic netting helped to reduce the numbers of transfers required to settle accounts. The regularly scheduled clearing in both types of markets also allowed early detection of financial troubles. In the futures markets, as noted above, periodic clearing and posting of variation margin before contract expiration mitigated the potential cumulation of losses and "gambling for resurrection" of counterparties experiencing distress. The margin call, thus, is an important way to control risk in response to the relatively long horizon of futures contracts. It provides a way to monitor the soundness of a counterparty during the life of the contract.

The analogy in the bank clearing association is the requirement to transfer securities or specie to settle accounts among the banks when clearing occurs. Unlike the longer horizon futures contracts, bank notes and checks could be presented for immediate redemption and hence could be called at any time. The coordinated "call" at the periodic meeting of the clearinghouse prevented an excessive issue of bank notes beyond prudential limits. A bank that increased its note issue faster than more conservative banks would face adverse clearings and have to provide gold or securities to settle. If the bank did not have the assets to transfer, the result of the clearing meeting would be to reveal its strategy and prevent the bank from continuing along this path.

This "law of reflux" was the basis of the private clearing mechanism that emerged during the eighteenth century "free banking" era in Scotland which had been quite successful in checking overissues (see White 1984 and Kroszner 1997a). The Suffolk System, a private payments mechanism that operated in New England during the mid-nineteenth century, also appears to have been effective in preventing excessive bank note issues and

^{11[11]} CHIPS has recently taken some steps towards controlling counterparty risks and moving toward partial mutualization of some risks (see Richards 1995).

^{12[12]} The Fed still does so for among central banks but not for private banks. Many central banks from around the world keep gold in the vaults of the New York Fed, which transfers gold bars among the cages in settlement of international transactions.

detecting financial difficulties of member banks (see Calomiris and Kahn 1996 and Kroszner 1996).^{13[13]}

The bank clearing and payments associations also monitored their member institutions more directly. In some cases, explicit rules on capital and liquidity were set up. More typically, there was a general requirement for soundness, and the clearing house had the right to demand to examine a member's books, similar to what futures clearinghouses did. Much as the creation of a futures clearinghouse as a counterparty to all transactions helped to improve the liquidity of contracts traded on the exchange, membership in a clearing association appears to have helped to increase the acceptability of a bank's notes. Fenstermaker and Filer (1986) and Calomiris and Kahn (1996), for example, find that the existence of the Suffolk System enhanced the willingness of people to hold currency issued by its members.

Bank clearing houses did not explicitly guarantee the notes and checks of the members. Member institutions that had fallen on hard times might have their memberships revoked and a takeover of a troubled member by another might be arranged. In times of general banking difficulties, there is some evidence that clearinghouses assumed some lender of last resort functions (see Kroszner 1997a and 1998a). Rolnick, Smith, and Weber (1998a, 1998b, 1998c), for example, show that the Suffolk Bank became a very large provider of interbank credit. Its position as operator of the note clearing system provided it with information that would help to determine who would be a good credit C an economy of scope between credit provision and bank clearing systems. Interestingly, the net credits provided by Suffolk to the rest of the system rose dramatically during times of general bank crises. While Suffolk certainly provided no explicit guarantees of the solvency and liquidity of its members, the Suffolk bank may have had an incentive to be concerned about the integrity of the system as a whole (to maintain the "seal of approval" reputational value of Suffolk membership).

The New York Clearing House Association (NYCHA) of banks appears to have assumed an implicit guarantor and lender of last resort role during periods of financial distress. Founded in the 1853, the NYCHA became actively involved in trying to prevent banking "panics" from spreading among its members. One of the most important responses was for the clearinghouse to issue its own certificates that would be acceptable in the payments of debts among clearinghouse members (see Gorton 1985, Mullineaux 1987, Gorton and Mullineaux 1987, and Calomiris 1990). These certificates were obligations of the clearing house, not of an individual member. This practice began in the Panic of 1857, and they were issued during every major panic until the founding of the Fed in 1914. These temporary issues could be quite sizeable. In the Panic of 1907, for example, these certificates amounted to almost five percent of money stock (Gorton 1985). In addition, during panics, the NYCHA would tend to suppress reports of individual bank

^{13[13]} Since the 1880s, Canada has had a successfully operated private payments system (see Redish 1991).

financial positions but instead report a single aggregate account of liquidity and capital for all of its members.

The actions by the bank clearinghouse in panic times thus was very similar to the mutualization of risk that the clearinghouse played in the regular operation of the futures markets. During distress, the NYCHA temporarily "merged" the members banks and issued obligations for which the members were jointly liable. Using the holding company analogy from the previous section, during times of distress the NYCHA acted as the holding company that reported a "consolidated" balance sheet for its subsidiaries and issued obligations of the holding company, not of the individual subsidiaries. For the futures clearinghouses, the guarantees against default were issued by the "holding company." In both cases, the assets of the "subsidiaries" could be called upon to back the certificates or the guarantees. This set of actions helped to mitigate "me-first" problems than can cause liquidity problems at one institution to spread and possibly generate solvency problems throughout the system.

The NYCHA structure thus involved "contingent integration" of the members to avoid system-wide troubles. The futures clearing house as a counterparty and guarantor to all transactions, thus, could be thought of as the bank clearing house in "panic" mode. The mutualization of risk and losses in banking crisis times is precisely the explicit role that the futures clearing association fulfilled in normal times. Both types of clearinghouses involved integration that was contingent on the state of the market, but the nature of the integration was on a more permanent basis through the futures clearinghouse.

One reason perhaps for the "permanent panic" mode of the futures clearinghouse relative to bank clearinghouses may be differences in the horizons of the financial contracts. Futures typically involve longer time periods of counterparty risk exposure than bank contracts that are primarily short-term, demandable debt. Bank liabilities are payable upon presentment to the bank, so holders of these contracts have a means of testing their bank's soundness whenever they so choose. The futures contract alone does not give the holder the ability to test the soundness of a counterparty until expiration, so futures market participants have an incentive to develop devices such as margin requirements and ongoing guarantees to control risk exposure. The contrast between exact nature of the integration through futures and bank clearinghouses may thus arise from differences in the horizons and risks inherent in the financial contracts themselves.

The evolution of futures and bank clearing and payments mechanisms illustrates how some form of contingent integration has been an important element of the market's response to controlling risk and the likelihood of system-wide trouble. In the next section, I discuss how recent developments in the derivatives markets that have made it possible to reproduce many of the risk management benefits of the exchange in a much more decentralized manner that allow for much greater flexibility in the financial contract.

3. CHALLENGES TO THE CLEARINGHOUSE: THE RISE OF THE OVER-THE-COUNTER MARKET AND THE DERIVATIVE PRODUCT COMPANY

While clearinghouses have been successful in managing and controlling risk and, with some variation, adopted by all derivatives exchanges, exchange-based trading has been facing increasing competition from the over-the-counter (OTC) market. Figure 2 shows that OTC derivatives have grown much more rapidly during the 1990s than exchange-traded derivatives. The total notional amount of OTC derivatives outstanding is more than double the notional amounts of exchange-traded derivatives.^{14[14]}

Why would traders forego the benefits conferred by the exchange and its clearinghouse? The benefits of the exchange-traded products are achieved at the cost of standardizing the contracts to make them fungible and liquid, but recent advances in financial theory and computing power have altered this trade-off in two key ways.^{15[15]} First, innovations in risk measurement and management techniques have increased the ability to monitor credit risks of counterparties and have enhanced the role of rating agencies such as Moody's and Standard and Poor's to be the delegated monitors to assess the credit quality of counterparties. Second, the new techniques also have increased the demand for individually-tailored products for hedging firm-specific risks and made the creation of more sophisticated products feasible.

These forces have led to a "dis-integration" of the exchange-clearinghouse system and the rise of customized contracts traded in the OTC market. A new type of organization form, called the Derivatives Product Company (DPC), has developed to provide some of the benefits of the exchange-clearinghouse system while preserving the flexibility and decentralization of the OTC market. A private trade association, the International Swap Dealers Association (ISDA), provides a "master agreement" which provides standard definitions of terms used in OTC derivatives and guidelines for the formulation of contracts, but the contracts are individually-tailored. As Table 2 shows, the recent innovations can be interpreted as a partial return to the pre-clearinghouse days of customized contracts, albeit with very different risk properties. I describe new organizational and contractual innovations that permit many of the benefits of risk control on the exchange to be reproduced at low cost in a much more decentralized way that permits much customization of the contracts.

In OTC markets, there is no formal institution to provide guarantees and there is little if any formal government regulation controlling such transactions. In immediately verifiable, payment-vs-delivery types of transactions, the credit quality of the agents is

^{14[14]} In discussing recent developments, I am switching terminology to use the more general term "derivatives" rather than "futures.@"

^{15[15]} Derivatives exchanges also have been subject to increasing regulation over time, and some have argued that the increasing costs of the regulation have been driving trading into the unregulated OTC market (e.g., DiClemente and Ondera 1998). Given that many of the products in the OTC market are not simply substitutes for exchange-traded derivatives, regulation alone is unlikely to account for the development of the OTC market.

not of great importance. Most financial markets, however, do not have these characteristics, since there is typically some time between the execution of the transaction and settlement. The time horizon in futures and derivatives contracts often is quite long, such as in interest-rate swap contracts that are common in the OTC market. The traders must develop methods to enhance their own credibility to compete with other agents to complete a transaction (see Darby and Karni 1973, Klein 1997, and Kroszner and Rajan 1997).

Credit rating agencies play the important certification role as third party monitors in such markets. The rating agencies, however, do not "put their money where their mouth is" and do not play the guarantor role that a clearinghouse does. On an exchange, effectively all trades have the same degree of security (or effective credit rating) since the same entity is guaranteeing all of the trades. In the OTC market, however, each transactor is exposed to risks unique to each counterparty. Credit rating agencies are the effective regulators in setting standards for capital, collateral, and conduct, much like clearinghouses and government regulators, but do not have a direct financial stake in the transactions.

In the late 1980s and early 1990s, concerns about credit risk increased following the bankruptcies of a number of prominent players in the OTC derivatives market (see Remolona, Basset, and Geonum 1996).^{16[16]} The response by market participants was to work with credit rating agencies to develop a new vehicle to address credit risks. Firms with relatively weak credit ratings wished to be able to continue to participate in the OTC markets and compete with large firms with high credit ratings. The organizational innovation, called the Derivatives Product Company (DPC), obtains a high credit rating while minimizing the amount of capital that must be contributed by the sponsor or parent firm of the DPC. The following excerpt from Moody's describes how a DPC can achieve a top credit rating:

Moody's does not believe that there is a single "correct" way to structure a DPC. One key feature, however, that is common...is a reliance on "mirrored" (or "back-to-back") transactions to eliminate market risk that the DPC would otherwise face. In effect, the DPC serves as an intermediary that passes market risk back to the sponsor....An essential component of the DPC is the provision of sufficient resources, including capital, collateral, and other forms of credit support. Moody's does not believe that there is an absolute standard of capital adequacy; instead, capital must be scaled to the risks associated with each DPC's business. (Moody's, October 1993)

Standard and Poor's gives a similar guideline for the structure of a DPC:

^{16[16]} When Drexel Burnham and Lambert failed in 1990, for example, it had \$30 billion (notional) in derivatives contracts outstanding with roughly 200 counterparties (see Remolona et al. 1996).

An enhanced derivative product company (DPC) is a company set up specifically to intermediate, guarantee, or enter as principal into derivative product transactions. The company's credit quality is derived largely from its own capital base....they do not rely on a parental guarantee for their credit ratings....The DPC is capitalized to some level appropriate for the scope of its business and rating. (S&P, June 6, 1994)

Table 3 shows that a number of structured DPCs have been created in the 1990s. Another type of DPC, which is a subsidiary that simply derives its high credit rating from a highly rated parent, also has arisen. The latter organizational form is not as novel as the "structured" DPC, so our focus will be on the "structured" DPC.

As the excerpts from Moody's and S&P illustrate, the agencies give a large degree of flexibility to market participants to develop methods for satisfying the requirements for a high credit rating. Market participants have innovated in three key areas to satisfy the rating agencies, and these common features illustrate the special structure of the DPCs.^{17[17]} The first involves almost complete hedging of their market risks. The second involves careful monitoring and measuring of credit risks in which capital is dynamically allocated as credit risks change. Third, the DPCs attempt to pre-package and privatize the bankruptcy or "workout" procedures to reduce uncertainty about how counterparties will be affected if the first two risk management procedures fail.

Market Risks

As Moody's notes in its definition of a DPC, the primary techniques that a DPC uses to manage market risk are "mirror transactions" with the parent or sponsor of the DPC. Figure 1 provides an example of how mirror transactions operate for a typical interest rate swap. A customer swaps a floating rate obligation for a fixed rate obligation from the DPC. Typically, the swap will have a zero value when the contract is signed but subsequent movements in interest rates will generate gains on one side of the transaction and losses on the other. The DPC is exposed to so-called market risk since a fall in interest rates would reduce the value of its position. To insulate itself from the risk of adverse interest rate movements, the DPC simultaneously engages in an identical swap with its sponsor, that is, the DPC swaps a floating rate obligation for a fixed rate one from the sponsor.

While the mirror transactions insulate the DPC against market risk, the DPC is exposed to credit risk from the potential failure of its sponsor. To address this risk, the sponsor must post collateral with the DPC. Rather than collateralize each transaction separately, total amount of collateral is based on the *net* exposure to the DPC. If the net marked-to-market portfolio value of the DPC's mirrored contracts is positive (that is, the DPC is "in the money"), then its sponsor will post collateral with the DPC. If, however, the net value of the DPC's mirrored contracts is negative ("out of the money"), then the sponsor

^{17[17]} The institutional descriptions in this section draw on (Remolona et al. 1996).

will not have to post any collateral with the DPC. The arrangement between the DPC and the sponsor thus permits them to benefit from the same scale economies in securing transactions that a central clearinghouse enjoys on an organized exchange while permitting the creation of customized contracts tailored to user-specific demands. The DPC engages in transactions with a many customers but, through the mirror transactions with the sponsor, can consolidate the wide variety of transactions so only a small amount of capital is required to collateralize fully its operation. Through the organizational innovation of the DPC and the associated mirror contracts, the sponsor effectively creates its own "mini" derivatives exchange, with its own netting, clearing, and settlement system. The decentralized OTC market thus introduces an important source of competition and discipline for the organized exchanges.

Credit Risks

The management of credit risk at the DPCs illustrates the special regulatory role played by the rating agencies and the importance of new risk modeling techniques. DPCs maintain a triple-A rating by using a combination of capital minima, collateralization, and activity restrictions. Each DPC has a quantitative risk assessment model which uses probabilities of failure and the extent of losses from past experience to simulate the extent of the DPC's current credit risk exposure. A risk tolerance level is set to be consistent with a triple-A rating, and the model then calculates the minimum amount of capital required and exposure limits to counterparties. The model used at Merrill Lynch's DPC, for example, requires that it be able to survive seven of its double-A rated counterparties defaulting simultaneously (Remolona et al. 1996).^{18[18]}

The exposure limits and capital requirements are updated frequently. Most of the DPCs use a dynamic capital allocation rule that requires daily adjustment of capital to changes in credit risk exposure. The credit rating agencies do not specify a particular model but instead require third-party auditors to certify the reasonableness of the model and risk tolerance levels chosen by each DPC. The frequent recalculation of the capital requirements parallels how margin requirements operate on organized exchanges to address default risks. Again, all of this is done within this innovative organizational design.

From a public regulator's perspective, the activity restrictions and exposure limits are a particularly important aspect of the design. Public regulators have what might be called a "rotten apple" theory of "systemic" crises, that is, one bad firm can bring down a bushel of otherwise good firms and cause a financial "meltdown" and credit "gridlock." The credit rating agencies appear to have somewhat similar concerns about credit risk. As a result, the negotiations between the rating agencies and the DPC sponsors have led to

^{18[18]} The capital levels are high relative to those banks must hold under the Basle Capital Accord. Remolona et al. (1996), for example, estimate that DPCs hold between seven and nine times the minimum amount of Tier I capital that would be required if the Basle Accord applied to them.

activity restrictions and exposure limits that would embody protections against exactly these types of problems. The charters of the DPCs of Merrill Lynch, Lehman, and Morgan Stanley, for example, require that their counterparties be rated at least A3/A- (Moody's/S&P) [*Swaps Monitor*, August 26, 1996]. If a counterparty is subsequently downgraded below this level, then the DPC must either transfer the transaction to the sponsor or hold more capital.

Requiring that the DPCs transact only with other entities with high credit ratings, as well as setting tight overall risk tolerance levels and requiring frequent recalculation of credit risk, is one way to attempt to reduce the likelihood of a trouble somewhere in the system cascading through to injure the DPCs. The high credit rating of the DPC and the measures protecting it against default parallel the high credit quality of the exchange-based clearinghouse and the restrictions on membership that are used to control risk on the exchange.^{19[19]}

Workout Structures

Although the DPCs are structured to permit them to withstand significant negative shocks, the market participants are aware that the DPCs are not risk-free.^{20[20]} The DPC charters thus include detailed descriptions of how the contracts would be resolved in the event of failure and precisely what events would trigger the workout process, a form of "pre-packaged" bankruptcy procedures. This reduces uncertainty about how contracts will be handled in a collapse. Events that would trigger the workout process include: downgrading of the sponsor, downgrading of the DPC, failure of the sponsor to meet capital obligations or post required collateral, bankruptcy or default by the sponsor, and actions taken by regulatory agencies.

Workout structures fall into two classes: contingent manager or continuation structure and early termination structure. The two structures appear to be equally popular, with about half of the DPCs using each one. Both have been used to deal with past defaults in the derivatives markets, but in these cases the customers did not know in advance how the default would be handled (see Remolona et al. 1996). In the contingency manager or continuation structure, the DPC would not enter any new contracts and a pre-specified contingent manager would administer the DPC until the last contracts expired. Under early termination, the DPC would unwind all of its positions within a few weeks. Customers with out-of-the-money contracts pay into the DPC, and the DPC uses these revenues to pay off customers with in-the-money contracts. The termination prices are determined at "mid market" by a pre-specified pricing model that the DPC uses.

^{19[19]} Pirrong (1998b) argues that individual counterparties and rating agencies may be more efficient monitors of risk for highly sophisticated "exotic" derivatives than clearinghouses.

^{20[20]} Also, given the extreme costs of creating a default-proof structure, if such an entity could exist, the optimum amount of default unlikely to be zero.

The detailed specification of an orderly workout procedure is an important innovation in the design of the DPCs in that it can help to reduce system-wide problems in a crisis. First, it allows customer ex ante to weigh the costs and benefits of the alternative structures and develop a risk management strategy consistent with the workout structure of their counterparty. With a better ability to forecast what would happen to their contracts in a crisis, customers will be better able to structure their own contingency plans to improve their ability to survive a financial crisis. The whole system thus is likely to be less "fragile" when a major shock hits.

Second, the reduction of uncertainty embodied in orderly and clear workout procedures will help to permit market participants to value the net worth of counterparties in a crisis. Uncertainty and information asymmetries that render otherwise "solid" assets unacceptable as collateral for borrowing (due to an inability to value the asset) and/or illiquid are typically seen as a key aspect of a system-wide crisis. No DPC or workout procedure can completely eliminate uncertainty in a major crisis, since the legal system could become unstable and contracts and property rights might not be enforced, but the innovative DPC organization and contract structure is a significant step toward controlling those risks.^{21[21]}

4. SUMMARY AND CONCLUSIONS

The evolution of risk control structures in derivative markets provides useful insights into how market mechanisms deal with risk through contractual and organizational innovation. The "partial permanent" integration of members of the clearinghouse to provide high credit quality helped to enhance the liquidity of standardized futures contracts traded on exchanges. Private bank clearinghouses adopted a "contingent" integration of its members in times of system wide bank panics. More recently, the safety and soundness benefits of the clearinghouse have recently begun to be reproduced in the decentralized OTC market that allows for more flexibility and customization of the contracts. The Derivative Product Company structures have incorporated important risk control features of organized exchanges into a new form which does not have the features of a members-only club. The credit rating agencies and greater sophistication of risk assessment models have largely substituted for the clearinghouse and government regulators in setting high standards and encouraging innovations to reduce the costs and likelihood of a system-wide failure in the OTC market. The DPCs and the innovations supporting the growth of the OTC market also have provided an important source of competition for the exchanges.

Historically, the private markets have been very sensitive to credit risk issues for both individual institutions and for the system as a whole. This study of the evolution of micro-institutions has emphasized how contracts and organizations in futures and

^{21[21]} Interestingly, the innovations in these workout procedures have led to revisions of the relevant US bankruptcy codes, integrating in ideas such as close-out netting. See revisions to 11 USC Sec. 362(b)(17).

banking markets can be understood as responses to risk control problems. Market forces led to important innovations and the resulting structures, particularly in the futures markets, have appeared to have performed reasonably well. Today in the largely unregulated OTC derivatives markets, we again see these concerns about risk management leading to further innovation and new organizational forms. Striving for competitive advantage in these markets has generated the private regulation that has helped to promote the growth of these markets. The lessons of the developments in the derivatives markets suggest that competitive forces have and can control risk in ways that can address public regulators' concerns about safety and soundness of the payments and clearing system.

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TABLE 1: Exchanges and Clearinghouses in the U.S.

| Derivatives Markets | Clearinghouse |
|---------------------------------------|--|
| Chicago Board of Trade (CBOT) | Board of Trade Clearing Corp. (BOTCC) |
| Chicago Mercantile Exchange (CME) | CME Clearing House Division (CME)* |
| New York Mercantile Exchange (NYMEX) | NYMEX Clearing House Division (NYMEX)* |
| Commodity Exchange, Inc. (COMEX) | Comex Clearing Association (CCA) |
| Coffee, Sugar & Cocoa Exchange (CSCE) | CSC Clearing Corporation (CSCCC) |
| New York Cotton Exchange (NYCE) | Commodity Clearing Corp. (CCC) |
| New York Futures Exchange (NYFE) | Intermarket Clearing Corp. (ICC) |
| MidAmerica Commodity Exchange (MidAm) | BOTCC |
| Kansas City Board of Trade (KCBOT) | KCBOT Clearing Corp. (KCBOTCC) |
| Minneapolis Grain Exchange (MGE) | MGE Clearing House Division (MGE)* |
| Chicago Rice & Cotton Exchange (CRCE) | BOTCC |
| Amex Commodities Corp. (AmexCC) | ICC |
| Philadelphia Board of Trade (PHBOT) | ICC |
| Six Options Markets** | Options Clearing Corp. (OCC) |

* Clearing House is a department within the exchange, whereas all other clearinghouses are separately incorporated.

** Chicago Board Options Exchange, American Stock Exchange, Philadelphia Stock Exchange, New York Stock Exchange, Pacific Stock Exchange, National Association of Securities Dealers.

Source: Rutz (1989).

FIGURE 1: Payment Flows of an Interest Rate Swap for a Mirrored Transaction for a DPC

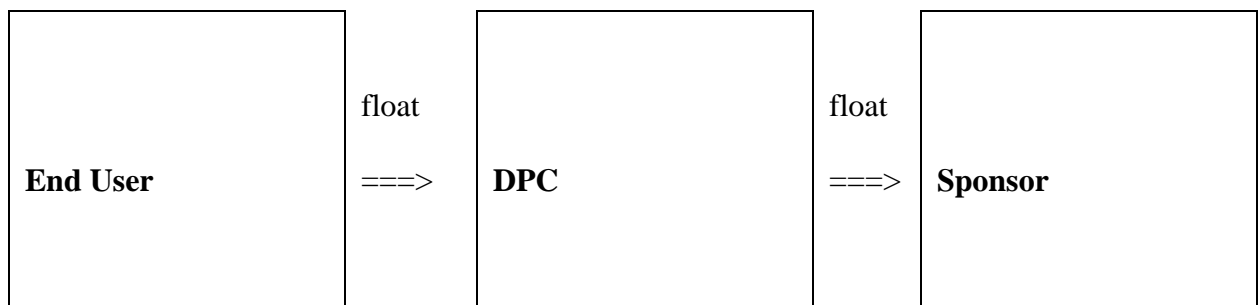




FIGURE 2: Growth of Derivatives, Net Bank Lending, and Net Securities Issues in International Financial Markets, 1987-1996 (in billions of U.S. dollars)

Source: Bank for International Settlements (1997b).

TABLE 3: Major Derivative Products Companies (DPCs)

| Date | Name | DPC Rating¹ (S&P/Moody) | Sponsor Rating (S&P/Moody) |
|-------------------------------|--|---|---|
| <u>STRUCTURED DPCs</u> | | | |
| 11/91 | Merrill Lynch Derivative Products | AAA/Aaa | A+/A1 |
| 3/93 | Salomon Swapco | AAAt/Aaa | BBB+/Baa1 |
| 11/93 | Paribas Derives Garantiss | AAAt/Aaa | A/A1 |
| 11/93 | Westpac Derivative Products | AAAt/Aaa | A+/A1 |
| 1/94 | Morgan Stanley Derivative Products | AAAt/Aaa | A+/A1 |
| 1/94 | Lehman Brothers Financial Products | AAA/Aaa | A/Baa1 |
| 10/94 | Credit Lyonnais Derivative Program | AAAt/Aaa | A-/A3 |
| 2/95 | Tokai Derivative Products | AAA/Aaa | A-/A2 |
| 4/95 | Sumitomo Bank Capital Markets Derivative Products | AAA/Aaa | A+/A1 |

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DPCs WHICH DERIVE THEIR RATINGS FROM THEIR HIGHLY RATED PARENTS

| | | | |
|---------|---|---------|----------------------|
| 7/90 | Credit Suisse Financial Products | AAA/Aa2 | AAA/Aa2 |
| 10/90 | General Re Financial Products | AAA/Aaa | AAA/Aaa |
| 12/93 | Goldman Sachs Mitsui Marine Derivative Products | AAA/Aaa | AAA/Aaa ² |
| 11/97 * | First Chicago Tokio Marine Financial Products | AAA/Aaa | AAA/Aaa ² |

¹ S&P suffixes At" to denote a termination structure which warns that counterparties to a terminating DPC might not have their contracts run to maturity.

² These ratings apply to the co-sponsoring Japanese insurance company.

* Announced.

Sources: Remolona et al., Moody's, S&P, *Swaps Monitor*.

TABLE 2: Characteristics of Alternative Structures for Trading Derivatives

| Prior to Organized Exchanges (Forwards) | Exchange with Clearinghouse | Over-the-Counter Derivative Products |
|--|------------------------------------|---|
| Decentralized | Centralized | Decentralized |
| Unorganized | Organized | Organized |

| Prior to Organized Exchanges (Forwards) | Exchange with Clearinghouse | Over-the-Counter Derivative Products |
|--|---|--|
| No Standardization | Standardized Contracts | Customized Contracts Broad Standards |
| High Transactions Costs | Low Transactions Costs | Low Transaction Costs |
| Very High Monitoring Costs | Monitoring Costs: High if no Central Guarantor Low if Clearinghouse Guarantor | Monitoring Costs Low due to Rating Risk Models |