BANK FOR INTERNATIONAL SETTLEMENTS

CLEARING ARRANGEMENTS FOR EXCHANGE-TRADED DERIVATIVES

Report prepared by the Committee on Payment and Settlement Systems of the central banks of the Group of Ten countries

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Foreword

The rapid growth of financial derivatives over the last decade has been the subject of numerous studies by central banks and regulatory authorities and by private sector groups. Much of this work has focused on derivative transactions privately negotiated in the over-the-counter markets. Exchange-traded derivatives have received less attention, perhaps because the regulatory framework for such instruments has been in place for some time, and the financial integrity of futures and options markets has withstood some rigorous tests. Nonetheless, stresses that were evident following the October 1987 stock market declines and the February 1995 failure of Barings underscore the need to critically examine the financial safeguards available in the various markets across the world.

The financial integrity of futures and options markets depends on the robustness of their arrangements for clearing and settling trades. The present report, prepared by the Ad Hoc Study Group on Exchange-Traded Derivatives, describes and analyses clearing arrangements for exchange-traded derivatives in the G-10 countries. The focus is on exchanges' clearing houses, which are at the heart of their clearing arrangements and are absolutely critical to their integrity. The Study Group's work is analytical rather than prescriptive - it discusses the sources and types of risks to clearing houses and the risk management safeguards that clearing houses employ to manage those risks. The report identifies several specific sources of potential vulnerability in clearing house risk management systems: (1) inadequate financial resources to meet losses and liquidity pressures from member defaults induced by extreme price movements; (2) a lack of mechanisms to monitor and control intraday risks; and (3) weaknesses in money settlement arrangements, including reliance on payment systems that entail the risk of unwinds of provisional funds transfers late in the day.

For each potential weakness identified, the report points out ways to strengthen clearing arrangements: (1) the use of "stress testing" to identify and limit potential exposures to clearing members from extreme price movements, and to ensure that the clearing house's financial resources are adequate in such circumstances; (2) enhanced intraday risk management through more timely trade matching and more frequent calculation of exposures and through the development of the capacity to reduce intraday exposures by means of more frequent settlements; and (3) strengthening of money settlement arrangements through the use of real-time gross settlement (RTGS) systems for payments and securities transfers and by clarifying settlement agreements with clearing members and settlement banks. As the report suggests, clearing houses should carefully assess whether implementation of these steps would produce benefits, including reductions in systemic risk, that outweigh the costs.

The annexes to the report contain a wealth of information on the risk management procedures and money settlement arrangements at selected clearing houses in the G-10 countries. While the body of the report emphasises the similarities in approaches to risk management across clearing houses, the details often differ, and these differences can be significant to the assessment of the effectiveness of risk management procedures at individual clearing houses. The analytical framework developed in the report should aid both market participants and those responsible for the supervision and regulation of clearing houses in making informed assessments of the robustness of individual clearing arrangements.

The Committee is indebted to Patrick Parkinson for his excellent leadership in chairing the Study Group. Able assistance in editing and publishing the report was provided by the BIS.

William J. McDonough, Chairman,
Committee on Payment and Settlement Systems
and President, Federal Reserve Bank of New York

Members of the Ad Hoc Study Group on Exchange-Traded Derivatives

Chairman	Mr. Patrick Parkinson, Board of Governors of the Federal Reserve System
National Bank of Belgium	Mr. Johan Pissens
Bank of Canada	Mr. Kevin Clinton
Bank of England	Mr. Ian Tower
Bank of France	Ms. Marie-Sybille Brunet-Jailly Mr. Jérôme Lachand
Deutsche Bundesbank	Mr. Jochen Metzger
Bank of Italy	Mr. Pietro Stecconi
Bank of Japan	Mr. Masao Okawa
Netherlands Bank	Mr. Pim Claassen
Bank of Sweden	Mr. Martin Andersson
Swiss National Bank	Ms. Katharina Bibus Mr. Stéphane Fumeaux
Board of Governors of the Federal Reserve System	Ms. Patricia White
Federal Reserve Bank of New York	Mr. Kurt Wulfekuhler
Bank for International Settlements	Mr. Paul Van den Bergh

Significant contributions were also made by Mrs. Fiona Ashworth and Mr. Neil McKenzie (Bank of England), Ms. Kim McPhail (Bank of Canada) and Mr. Hans Detmering (Deutsche Bundesbank).

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1. EXECUTIVE SUMMARY

The trading on organised exchanges of derivative financial instruments, that is, futures and options on interest rates, exchange rates and equities and equity indices, has grown enormously over the past decade or so. These markets are now a critical component of the financial infrastructure of the G-10 countries and a growing number of other developed and developing countries. In particular, when they measure the market risks associated with their activities, many financial market participants, including the major banks and securities firms that serve as market-makers for securities and over-the-counter (OTC) derivatives, assume that markets for exchange-traded derivatives will provide sufficient liquidity to allow them to offset their market risk exposures quite promptly, even during episodes of market volatility when other financial markets may be relatively illiquid. Furthermore, although on a day-to-day basis the amounts of payments and securities deliveries associated with exchange-traded derivatives are typically relatively insignificant, during periods of market volatility these amounts can increase by an order of magnitude, and financial market participants may depend critically on the timely completion of such payments and deliveries in managing their liquidity risks. Consequently, when markets are already under stress, the loss of an exchange's market liquidity or a delay in the completion of exchange-related payments or deliveries could well lead to systemic disturbances - the liquidity of other financial markets could be seriously impaired, and payment systems and other settlement systems could be disrupted.

Both the liquidity of exchange-traded derivatives markets and the timely completion of payments and deliveries associated with these markets are critically dependent on the financial integrity of an exchange's clearing house, in which are concentrated the credit and liquidity risks of exchange trading and the responsibility for managing those risks. To be sure, a default by a member of the clearing house that intermediates between the clearing house and many other trade counterparties could, by itself, cause losses to its clients and perhaps shake confidence in the exchange. But if the clearing house were able to cover any losses it might suffer from the default and continue to meet its obligations on schedule, the likelihood of systemic problems would be greatly diminished. Thus, this report focuses primarily on risks to an exchange's clearing house.

More specifically, the primary objective of the Study Group's work has been to develop a clearer understanding of the sources and types of risk to clearing houses for exchange-traded derivatives and of the techniques that such clearing houses utilise to manage those risks. In particular, the Study Group has sought to identify weaknesses in clearing house risk management practices that could, in principle, be the source of systemic disturbances and also to identify steps that clearing houses might take to address any such weaknesses. Special attention has been paid to weaknesses in clearing houses' money settlement arrangements and to opportunities for strengthening those arrangements.

An exchange's clearing house may be a department of the exchange or a separate legal entity. In several cases a single clearing house provides clearing services to more than one exchange. In all but a very few cases the clearing house acts as the central counterparty to all trades on the exchange. The clearing house's counterparties are its clearing members, which generally are a subset of the exchange's members. Other trade counterparties, both non-clearing exchange members and non-members of the exchange, must become clients of one of the clearing members, either directly or through another intermediary. The clearing house typically has a principal-to-principal relationship with its clearing members. Thus, it looks to the clearing members for performance on trades for their own account and on trades for the account of their clients. In most cases a clearing member has a principal-to-principal relationship with its clients, but in some cases it is characterised as an agency relationship.

In addition to the clearing house and its clearing members, another key element of the settlement infrastructure for exchange-traded derivatives is the bank or network of banks through which money settlements are effected. The central bank acts as settlement bank in about half of the G-10 countries. In the other countries networks of private settlement banks are utilised. The use of different models in different countries appears largely to reflect a combination of differences in

financial industry structure and in central bank policies regarding access to accounts, hours of operation and provision of liquidity.

As central counterparty to its clearing members, the clearing house is exposed to the risk that one or more clearing members will default on their contractual obligations. This would generally expose the clearing house to replacement cost risks and also to liquidity risks. In addition, principal risks may exist if contracts provide for delivery (rather than exclusively for cash settlement) and if a delivery-versus-payment mechanism is not utilised to effect deliveries. In those cases in which clearing houses use private banks rather than central banks to effect money settlements, another source of credit and liquidity risks is the possibility of failure of a settlement bank. Clearing houses face other risks relating to the financial resources they typically maintain to help cover losses and ensure timely settlements; the investment of such resources usually entails some credit risks, liquidity risks, market risks or custody risks. And, like any other payment and settlement system, exchange clearing houses face various operational risks. Finally, clearing houses face legal risks. For example, bankruptcy laws or other laws may impede the operation of safeguards that the clearing house relies upon to limit its credit and liquidity exposures, and ambiguities in money settlement arrangements may lead to disputes regarding the obligations of the various participants in the event of a default.

The Study Group's review of the risk management procedures of exchange clearing houses in the G-10 countries has revealed that a common set of safeguards are typically utilised to limit the likelihood of defaults by clearing members and to ensure that if defaults do occur, the clearing house has adequate resources to cover any losses and to meet its own payment obligations without delay. These include: (1) financial and operational requirements for membership in the clearing house; (2) margin requirements that collateralise potential future credit exposures and either collateralise current credit exposures or limit the build-up of such exposures by periodically settling gains and losses; (3) procedures that authorise prompt resolution of a clearing member's default through close-out of its proprietary positions and transfer (to a non-defaulting clearing member) or close-out of its clients' positions; and (4) the maintenance of supplemental clearing house resources (capital, asset pools, credit lines, guarantees, or the authority to make assessments on non-defaulting members) to cover losses that may exceed the value of the defaulting member's margin collateral and to provide liquidity during the time it takes to realise the value of that margin collateral.

Clearing houses that utilise private settlement banks typically limit risks of settlement bank failures by selecting only the most creditworthy commercial banks. In addition, some clearing houses have structured their settlement agreements with the banks to minimise the clearing house's potential losses and liquidity pressures in the event that a failure should occur. Specifically, the agreements provide that transfers between clearing members and the clearing house on the books of each settlement bank are effected simultaneously and are final, and that final transfers of funds between settlement banks are effected as soon as possible. Together, these steps can reduce substantially the amount and duration of a clearing house's exposures to any one settlement bank.

The combination of risk management safeguards employed by exchange clearing houses has generally proved quite effective - in particular, there have been relatively few defaults by members of clearing houses in the G-10 countries, and none by settlement banks. Furthermore, in no case has the default of a clearing member caused the financial integrity of any of those clearing houses to be significantly impaired. In several cases, however, sharp movements in market prices have triggered events that raised doubts about the financial integrity of clearing houses, and in so doing, revealed sources of vulnerability. Examples include the global collapse of equity prices in October 1987, which triggered concerns about the integrity of clearing houses for stock index futures and options, especially in the United States, and the sharp decline in Japanese equity prices in early 1995, which triggered defaults by units of Barings Plc that were clearing members of exchanges' clearing houses in Japan and Singapore.

More generally, analysis of these approaches to risk management suggests that clearing houses simply cannot be made fail-safe. With respect to risks of clearing member defaults, neither the capital requirements that are intended to limit the likelihood of clearing member defaults, nor the

margin requirements that seek to limit potential losses in the event of defaults, are designed to cover extreme price movements. Thus, such an extreme price movement could lead to a clearing member's default, and the default could impose losses and liquidity pressures on the clearing house that could not be met fully by liquidating the defaulting member's margin collateral. In such circumstances, the clearing house would be forced to rely on its supplemental resources (including various contingent claims on its members) to cover the losses and meet its own payment obligations on schedule. However, the amounts of such supplemental resources at clearing houses in the G-10 countries vary considerably. While a growing number of clearing houses periodically reassess their need for such resources, there are no widely accepted methodologies or standards for assessing their adequacy.

Clearing houses may also experience unanticipated credit exposures to clearing members because they have only limited capabilities for monitoring and controlling intraday risks. To be sure, improvements in recent years in the speed with which clearing houses can match trades and compute open positions have enhanced their capacity to monitor intraday exposures. Moreover, most clearing houses now have the authority to conduct intraday margin calls, which offer a mechanism for managing intraday risk. Nonetheless, some clearing houses still measure their exposures to clearing members only at the end of the trading day.

Clearing houses also may be vulnerable to weaknesses in money settlement arrangements. The specific potential problems differ, depending on whether the central bank is used as the settlement bank or private settlement banks are used. Nonetheless, where those weaknesses exist, they have two common underlying sources: (1) the use of interbank payment systems that entail the risk of unwinds of provisional funds transfers late in the day; and (2) a lack of clarity regarding the obligations of the various parties in the settlement process - the clearing house, clearing members and settlement banks - in the event that a clearing member (or settlement bank) were to default.

Clearing houses that use central bank funds in settlements avoid the risk of settlement bank failure. However, in some countries in which central banks are used, the clearing house could receive a provisional payment from a clearing member early in the day but have the payment unwound late in the day because the clearing member could not cover a net debit balance at the central bank. In the interim, the clearing house's credit exposure to the defaulting clearing member could increase substantially as a result of price changes or new trades that increase the defaulting member's open positions. Moreover, if the payment system does not settle until late in the day (when money markets tend to be illiquid) and the defaulting member owed a substantial amount, the clearing house could have considerable difficulty meeting the resulting liquidity pressures. The risk of liquidity problems could be quite significant if the clearing house does not clearly recognise the provisional nature of transfers in the payment system (or incorrectly assumes that the central bank will take action to prevent any unwinds) and, therefore, has not made adequate preparations to cover the resulting shortfall.

When commercial banks are used as settlement banks, transfers on their books from clearing members to the clearing house may be final prior to transfers in the interbank payment system. However, transfers between settlement banks usually are not final until the central bank payment system achieves finality. Thus, the clearing house is exposed to settlement bank failure from the time its account at a settlement bank is credited until the time the payment system achieves finality. As in the case of an unwind of a payment from a clearing member, if a provisional payment from a settlement bank is unwound, the clearing house could have considerable difficulty covering the resulting liquidity shortfall. Furthermore, because settlement banks may receive payments from multiple clearing members, the credit losses and liquidity pressures from the unwinding of a settlement bank payment could be considerably larger than those from the unwinding of a payment from a single clearing member. Thus, as when the central bank is used as settlement bank, it is critical that the clearing house does not misperceive provisional payments as final payments. In addition, if a clearing house's legal agreements with its settlement banks and clearing members are not drafted clearly, there is a potential for disputes to arise in the event of a default of a clearing member or of a settlement bank. In particular, if it is unclear when and under what conditions the settlement banks will make (or irrevocably commit to make) final transfers from clearing members to the clearing

house, the clearing house could underestimate its credit and liquidity exposures to those members. Similarly, a proper assessment of the risks of settlement bank failures requires a clear understanding of when and under what conditions interbank funds transfers are considered final.

To the extent that individual clearing houses in the G-10 countries are vulnerable to the potential problems that have been identified, the Study Group has identified certain steps that they could take to reduce their vulnerability. The Study Group does not mean to imply that systemic risk considerations require any individual clearing house to take any of these steps. Nonetheless, the Study Group believes that clearing houses should carefully consider whether implementation of the steps discussed below could produce benefits that exceed the costs. The Study Group notes that public benefits in terms of reduced systemic risk would accrue from these steps and that each of the steps has already been taken by some clearing houses in the G-10 countries. The steps that the Study Group believes worthy of consideration are: (1) "stress testing" to identify and limit potential uncollateralised credit exposures and liquidity exposures to clearing members from extreme price movements, and to ensure that the clearing house's financial resources are of adequate size and liquidity; (2) enhanced intraday risk management through more timely trade matching and more frequent calculation of margin deficits and through the development of the capacity to conduct more frequent settlements of margin deficits or variation losses; and (3) strengthening of money settlement arrangements by utilising payment and securities settlement systems that provide real-time or at least intraday finality of funds transfers and by eliminating uncertainty about the obligations of the various participants in settlement arrangements in the event of a failure of a clearing firm or a settlement bank.

Stress testing is the selection of extreme price scenarios, that is, price movements not covered by margin requirements, and the simulation of potential losses and liquidity pressures that could result if such price movements led to a clearing member's default. Such tests can be used both to identify and to limit exposures to individual clearing members and to gauge the adequacy of the clearing house's financial resources. If the simulated credit exposures to one or more members approached or exceeded the amount of a clearing house's resources, it could either reduce the exposures (by requiring the individual members to reduce their open positions or increase their margin assets) or increase the size of its own resources. If the simulated liquidity needs exceeded available liquidity, the clearing house could require the members in question to post margin assets of greater liquidity or it could alter the composition or size of its own resources to provide greater liquidity.

Until recently many clearing houses in the G-10 countries had only limited ability to monitor their intraday exposures to clearing members and no effective mechanism to control those exposures. In such circumstances, clearing houses were vulnerable to unanticipated increases in exposures from new trades and extreme intraday price movements. However, with recent improvements in trade matching and processing capabilities, many clearing houses now have intraday information on exposures and some have real-time or near real-time information. And, with the recent or prospective introduction by central banks in many G-10 countries of real-time gross settlement (RTGS) payment systems, clearing houses in those countries could develop the capacity to actively manage their exposures to clearing members on an intraday basis through collection of cash margin. If securities settlement systems permit final intraday transfers of securities, clearing houses might also allow clearing members to cover margin deficits through deliveries of securities.

Clearing houses that still rely on interbank payment systems that permit the unwinding of provisional transfers late in the day will be able to reduce credit and liquidity risks substantially as central banks implement new RTGS payment systems or extend the hours of operation of existing systems. If a clearing house uses the central bank as settlement bank, by using the RTGS system it will be able to reduce the duration of its credit exposures to clearing members and eliminate the spectre of unmanageable liquidity pressures from an unwind of a large payment late in the business day. However, to ensure that it can make timely settlement in an RTGS environment, a clearing house would need to review its capacity to mobilise liquidity resources quickly should a clearing member default. With adequate planning, the availability of RTGS payment and securities settlement systems should, in fact, make it easier to mobilise resources quickly. If a clearing house uses private settlement banks, by requiring those banks to effect interbank transfers promptly over the RTGS system it will

be able to reduce the duration of its credit exposures to the failure of a settlement bank and avoid the potentially traumatic consequences of an unwind of a payment from a settlement bank. This will require modifications to a clearing house's legal agreements with its settlement banks and clearing members, which will provide an opportunity for it to review whether those agreements address obligations in the event of a default by a clearing member or settlement bank with sufficient clarity and, where necessary, to eliminate any existing uncertainty.

The rapid growth of exchange-traded futures and options in recent years has been accompanied by an increasing internationalisation of the markets and their clearing arrangements. Many clearing houses now clear foreign exchange contracts or contracts denominated in foreign currencies and often effect money settlements in those foreign currencies or accept foreign-currency-denominated collateral as initial margin. Also, most have clearing members that are units of foreign-based firms. Finally, as exchanges have looked to alliances with foreign exchanges to boost trading volumes, several clearing houses have developed links to facilitate the clearing of the resulting trades.

The Study Group has undertaken some preliminary analysis of the implications of these increasingly important cross-border elements in clearing arrangements for clearing houses. In general, these cross-border elements individually may make risk management more complex and potentially more difficult and, when combined, may compound the complexity and difficulty. When contracts are denominated in foreign currencies, money settlements must be effected in those currencies. Time zone differences and the need for banks to confirm receipt of payments by correspondent banks abroad may result in relatively longer delays before final foreign currency payments from clearing members to the clearing house are received (or before the clearing house can confirm that final payments have been received). When a clearing house accepts margin collateral in foreign currencies, in the event of a default a foreign exchange transaction may be necessary to convert the proceeds of the sale of the collateral into the currency needed by the clearing house, and time zone differences may make a same-day foreign exchange transaction impossible. When a clearing house accepts units of foreign firms as members, it may have difficulty assessing their creditworthiness and monitoring changes in their financial condition. In the event that a foreign member were to fail, its liquidator might challenge the clearing house's actions to implement its default procedures, although such a challenge would seem unlikely to succeed if the default procedures are supported by the clearing house's local law. However, if the clearing house is holding a defaulter's collateral in a foreign jurisdiction (especially the jurisdiction in which the defaulter or its parent is chartered), there is a more serious risk that the clearing house could be prevented from liquidating the collateral to cover its losses or meet liquidity pressures.

Links between clearing houses take two forms: clearing links and mutual offset systems. A clearing link involves a "home" exchange which is the primary exchange for the trading of the contract subject to the link (usually the exchange which introduced the contract) and an "away" exchange whose members may also trade the contract. The away clearing house acts as counterparty when a transaction is first initiated, but soon thereafter the home clearing house is substituted as counterparty to all transactions in home exchange contracts. By contrast, a mutual offset system allows exchange members to execute trades on both exchanges but to hold their positions with a single clearing house by transferring positions from one clearing house to the other. All clearing houses involved in cross-border clearing agreements face and must manage the risks that a clearing house faces in a domestic context. In addition, however, they face risks unique to these agreements. In a clearing link, a clearing house may face losses on positions that the other clearing house seeks to transfer to one of its members that is in default, or on positions that it seeks to transfer to a member of the other clearing house that is in default. In a mutual offset system, the clearing houses are exposed to loss from each other's default.

2. INTRODUCTION

The trading on organised exchanges of derivative financial instruments, that is, futures and options on interest rates, exchange rates and equity indices, began in the United States in the 1970s and early 1980s.[1] In the mid-1980s financial derivatives were introduced on exchanges in each of the other G-10 countries and in many other countries. As shown in Exhibits 1a and 1b, as late as 1986 exchanges in the United States still accounted for around 80% of total exchange-traded derivatives, both in terms of amounts outstanding and in terms of turnover. However, in the 1990s trading activity on non-US exchanges grew far more rapidly than that on US exchanges. By 1995, turnover of financial derivatives contracts at non-US exchanges exceeded that at US exchanges, and the value of outstanding contracts at non-US exchanges was only slightly smaller. Activity in 1994 had been boosted by exceptional volatility in global bond markets. Since then, turnover has fallen off in the aggregate and in most individual countries, while the value of outstanding contracts has grown much more slowly.[2]

The availability of financial derivatives - both standardised contracts listed on exchanges and tailor-made contracts privately negotiated with banks or other derivatives dealers (over-the-counter (OTC) derivatives) - has allowed financial market participants to unbundle financial risks and to manage the various risk components more effectively. In measuring and managing market risk, market participants must make assumptions about how promptly risk positions can be adjusted through market transactions. Markets for individual financial instruments, especially for tailor-made OTC derivatives, are often rather illiquid.[3] Nonetheless, when measuring market risks, market participants frequently use quite short time horizons.[4] In part, the use of such short horizons is often based on the assumption that the market risks associated with illiquid instruments can be promptly offset with positions in more liquid markets. In particular, it is assumed that markets for exchange-traded derivatives will provide sufficient liquidity to allow positions in less liquid instruments to be offset quite promptly, even during periods of market volatility when other financial markets tend to be relatively illiquid.[5] In this way, the exchange-traded financial derivatives markets have come to constitute a critical component of the financial infrastructure of the G-10 countries and a growing number of developing countries.

Exchange-traded derivatives can also have important implications for the management of liquidity (funding) risk. As shown in Exhibit 2, daily average money settlements associated with exchange-traded derivatives are quite modest in absolute terms and, certainly, relative to the size of payment systems and money markets. However, peak settlement amounts are typically a multiple of the daily averages. Moreover, as shown in the right-hand column, historical peaks have reached levels an order of magnitude larger than the daily averages. Most important, as indicated by the dates of the historical peaks, in most cases they have occurred during periods when financial markets are undergoing significant stress, for example during the October 1987 stock market break or following major realignments of exchange rates or turning-points in global bond markets. During such periods market participants tend to be experiencing significant liquidity demands in cash markets as well as derivative markets. In such circumstances, they may depend critically on the timely receipt of funds and securities from exchange clearing houses to meet their liquidity needs.

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1 Options and warrants on individual equities had been traded earlier in many countries.

2 Outside the G-10 countries, the countries with the most active financial derivatives markets are Singapore, Brazil, Australia, Spain, Hong Kong, New Zealand, South Africa and Denmark.

3 Unlike exchange-traded derivatives or securities, OTC derivatives typically cannot be transferred or terminated without the consent of the original counterparty. The negotiation of a termination or transfer is inherently a time-consuming process.

4 For example, many market participants measure market risk using value-at-risk (VAR) measures that are calculated on the basis of one-day price movements.

5 Nonetheless, prudent risk managers perform stress tests that seek to quantify potential losses in abnormal market conditions, including protracted periods of market illiquidity.

Exhibit 1a

Financial derivatives traded on organised exchanges

(notional principal amounts outstanding at year-end, in billions of US dollars)

By country	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
All countries	**618.3**	**729.9**	**1,304.8**	**1,766.9**	**2,290.4**	**3,519.3**	**4,634.4**	**7,771.1**	**8,862.5**	**9,185.3**
G-10 countries	**594.7**	**699.1**	**1,235.7**	**1,667.3**	**2,150.9**	**3,298.4**	**4,379.7**	**7,301.8**	**8,154.0**	**8,563.6**
United States	517.9	577.7	950.3	1,152.3	1,263.0	2,132.1	2,675.5	4,316.3	4,750.0	4,788.8
United Kingdom	0.3	0.4	134.5	198.3	320.2	488.4	680.0	1,176.5	1,262.7	1,608.4
Japan	63.5	107.7	106.6	260.9	424.2	441.2	576.1	1,193.5	1,498.1	1,524.4
France	2.7	8.5	36.6	42.6	127.1	186.5	381.1	491.2	482.7	477.5
Germany	0.0	0.0	0.0	0.0	1.7	16.2	24.9	50.7	42.9	70.6
Canada	0.2	0.4	1.3	3.5	5.5	19.6	19.2	42.3	69.5	58.4
Netherlands	0.0	0.8	5.6	8.0	7.3	6.9	13.1	11.6	6.1	12.5
Switzerland	0.0	0.0	0.0	0.3	1.2	6.2	3.7	5.7	6.6	10.2
Belgium	0.0	0.0	0.0	0.0	0.0	0.1	1.5	6.9	4.3	7.2
Italy	0.0	0.0	0.0	0.0	0.0	0.0	3.5	6.6	3.0	4.0
Sweden	10.1	3.6	0.8	1.4	0.8	1.1	1.0	0.3	1.2	1.6
Other countries	**23.6**	**30.8**	**69.1**	**99.6**	**139.5**	**220.9**	**254.7**	**469.3**	**708.5**	**621.7**

Source: Bank for International Settlements.

Exhibit 1b

Financial derivatives traded on organised exchanges

(annual turnover volumes in terms of notional amounts, in billions of US dollars)

By country	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
All countries	**40,768.5**	**68,111.8**	**71,142.3**	**111,552.5**	**123,381.3**	**135,207.7**	**181,888.0**	**225,066.7**	**342,529.5**	**327,564.6**
G-10 countries	**39,774.9**	**65,460.4**	**67,336.6**	**104,379.7**	**116,195.7**	**127,474.4**	**170,469.3**	**211,063.1**	**315,479.4**	**300,915.9**
United States	31,440.9	44,892.8	43,115.8	67,515.4	65,608.4	70,536.0	101,674.6	112,440.7	174,553.0	160,368.5
Japan	5,905.6	14,878.7	16,024.4	21,597.1	29,176.4	30,179.1	25,877.7	39,005.3	55,479.8	54,195.3
United Kingdom	2,258.4	4,275.0	6,371.5	10,710.7	15,634.2	17,331.8	26,596.2	34,750.5	53,290.8	50,829.0
France	91.2	1,215.4	1,692.7	4,355.7	5,420.1	7,571.3	12,632.7	19,047.9	22,722.0	25,762.0
Germany	0.0	0.0	0.0	0.0	14.8	593.9	1,620.5	2,590.8	4,563.6	4,730.5
Canada	13.9	13.9	24.1	50.7	133.0	219.7	436.2	681.4	1,535.7	1,855.1
Sweden	55.3	180.1	83.6	67.8	122.9	792.9	1,118.2	1,425.7	2,016.0	1,806.5
Italy	0.0	0.0	0.0	0.0	0.0	0.0	96.7	647.6	670.3	562.8
Switzerland	0.0	0.0	0.9	12.2	26.6	168.8	273.9	167.7	312.9	381.4
Netherlands	9.5	14.6	23.7	61.5	59.4	79.8	83.8	130.9	149.3	217.0
Belgium	0.0	0.0	0.0	0.0	0.0	1.1	58.7	174.6	185.6	207.9
Other countries	**993.6**	**2,651.4**	**3,805.7**	**7,172.8**	**7,185.6**	**7,733.3**	**11,418.7**	**14,003.6**	**27,050.1**	**26,648.7**

Source: Bank for International Settlements.

Exhibit 2

Average and peak money settlements
Selected clearing houses for derivatives exchanges in the G-10 countries
(in millions of domestic currency units equivalents)

Country	Clearing house[1]	Daily average (1995)		Daily peak				
				1995		Historical (date)		
Belgium	BELFOX	BEF	50	BEF	120	BEF	120	(1995)
France	MATIF	FRF	696	FRF	3,494	FRF	10,958	(21/12/94)
Germany	DBAG	DEM	100	DEM	800	DEM	800	(17/03/95)
Italy	Cassa	ITL	18,000[2]	ITL	86,400[3]	ITL	140,200	(02/03/94)
Japan	TIFFE	JPY	1,915	JPY	15,984	JPY	15,984	(19/08/95)
Netherlands	EOCC[4]	NLG	66[5]	NLG	340[6]	NLG	340	(22/04/96)
Sweden	OM Stockholm	SEK	11	SEK	486	SEK	486	(1995)
Switzerland	SOFFEX	CHF	11	CHF	174	CHF	174	(18/08/95)
United Kingdom	LCH	GBP	585[7]	GBP	1,901[8]	GBP	2,327[8]	(16/11/94)
United States	BOTCC	USD	161	USD	570	USD	1,500	(10/87)
United States	CME	USD	280	USD	972	USD	2,500	(10/87)
United States	OCC	USD	140[9]	USD	195	USD	2,000[10]	(20/10/87)

[1] The full names of the clearing houses are shown in Annex 2. [2] Daily average of funds collected. The average daily amount of funds paid was ITL 16,700. [3] Peak amount of funds collected. The peak amount of funds paid was ITL 73,600. [4] Includes gross payments of option premiums. Because receipts and payments of clearing members are netted, actual settlement values are considerably lower than shown. [5] 1996. [6] 22nd April 1996. [7] Average daily money settlement value is the total of the amounts collected and paid; the figure includes delivery payments in respect of commodities business; however, delivery payments in respect of bonds and equities are excluded. [8] This figure is calculated on the same basis as the daily average. [9] Daily average of funds collected. The average daily amount of funds paid was USD 76 million. [10] Morning settlement. The largest ever intraday settlement occurred on 19/10/87 (USD 1,200 million).

During such periods of market stress, the loss of an exchange's market liquidity or a delay in the completion of settlements could well lead to systemic disturbances - the liquidity of other financial markets could be seriously impaired, or payment systems and other settlement systems could be disrupted. A loss of market liquidity could result in substantial unanticipated trading losses to dealers in OTC derivatives or in other financial instruments that had assumed the ability to offset positions promptly in measuring potential losses. The experience of unanticipated losses and the unavailability of efficient hedging vehicles could lead dealers to pull back from other financial markets, thereby adversely affecting the liquidity of those markets. Delays in completing money settlements associated with exchange-traded derivatives could cause the intended recipients to be unable to meet their obligations to other payment and settlement systems.

Both the liquidity of exchange-traded derivatives markets and the timely completion of payments and deliveries associated with these markets are critically dependent on the financial integrity of an exchange's clearing house. To be sure, a default by a member of the clearing house, especially by a firm that intermediates between the clearing house and many other trade counterparties, could, by itself, cause losses to its clients and perhaps shake confidence in the exchange. But if the clearing house were able to cover any losses it might suffer from the default and continue to meet its obligations on schedule, the likelihood of systemic problems would be greatly diminished. Thus, this report focuses primarily on risks to an exchange's clearing house. The relationships and related risk exposures between clearing members and their clients are generally discussed only to the extent that they are relevant to the financial integrity of the clearing house.[6]

More specifically, the primary objective of the Study Group's work has been to develop a clearer understanding of the sources and types of risk to clearing houses for exchange-traded derivatives and of the techniques that such clearing houses utilise to manage those risks. In particular, the Study Group has sought to identify weaknesses in clearing house risk management practices that could, in principle, be the source of systemic disturbances and also to identify steps that clearing houses might take to address any such weaknesses. Special attention has been paid to weaknesses in clearing houses' money settlement arrangements and to opportunities for strengthening those arrangements. Finally, the Study Group has also undertaken a preliminary analysis of the implications of the growing internationalisation of the trading and clearing of exchange-traded derivatives.

The next section outlines the basic structure of clearing and settlement arrangements for exchange-traded derivatives, including the relationships between the clearing house, its clearing members and their clients, and the role of settlement banks in money settlement procedures. Section 4 discusses the sources and types of risk faced by the clearing house. Section 5 identifies what are, in effect, the generic elements of the approach that clearing houses take to managing the risk of clearing member defaults. It also describes approaches to limiting the risks of settlement bank failures. Section 6 points to potential weaknesses in clearing houses' risk management procedures, and Section 7 identifies steps that can be taken to address those weaknesses. Finally, Section 8 considers some issues raised by the internationalisation of the trading and clearing of exchange-traded derivatives. Annex 1 is a glossary. Annex 2 provides information on key features of 16 clearing houses, including at least one in each of the G-10 countries. (This information summarises the results of responses by these clearing houses (or the exchange for which they clear) to a questionnaire drawn up by the Study Group.) Annex 3 provides information on money settlement arrangements employed by the individual clearing houses. Annex 4 presents a brief overview of various arrangements that are employed to protect the interests of clients of clearing firms. Annex 5 illustrates the mechanics of two different types of margin system - "futures-style" and "options-style" margining. Annex 6 is a bibliography.

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[6] The mechanisms that can be utilised to protect clients of a clearing firm or broker from the intermediary's insolvency have already been analysed in a paper on Client Asset Protection published recently by IOSCO's Technical Committee. See Technical Committee of the International Organization of Securities Commissions (1996a).

3. STRUCTURE OF CLEARING ARRANGEMENTS

3.1 Role of the clearing house[7]

Clearing houses provide a range of services related to guarantee of contracts, clearance and settlement of trades, and management of risk for their members and associated exchanges. In providing these services, clearing houses can be organised in a wide variety of forms: some clearing houses are organised as departments of their affiliated exchanges, others are independent legal entities. Some clearing houses provide services to only one exchange, others serve a group of exchanges. Some clearing houses are owned by their member clearing firms, others are owned by exchanges or are public corporations. Despite these organisational differences, clearing houses typically have a core set of common features. Most important, with very few exceptions, clearing houses in the G-10 countries serve as the central counterparty to deals struck between exchange members.[8] That is, the clearing house becomes the buyer to every seller of a contract and the seller to every buyer.

A critical issue for both clearing members and the clearing house is the time at which the substitution of the clearing house as counterparty occurs. The rules of some clearing houses provide that substitution does not take place until a trade is matched or until it has been registered on the books of the clearing house. Under such rules, unmatched (or unregistered) trades are, in principle, the responsibility of the counterparties involved, subject to the rules of the exchange and the exchange's arbitration procedures. In many cases, however, market participants may not be able to utilise the most basic protection against the counterparty risks that accompany such responsibility, that is, the ability to avoid trading with counterparties that they view as uncreditworthy; to maximise market liquidity and to ensure that client orders are treated fairly, exchanges often require trades to be executed at the best price available, regardless of the creditworthiness of the counterparty. In the event of a default by a counterparty, a clearing house could well make a business decision to assume the obligations arising from all trades that were ultimately matched, even if substitution had not occurred prior to the default. Still, when a clearing house's rules allow it to decline to be substituted, it is apparent that the clearing house is preserving the option to force the counterparties to bear any counterparty losses on such trades. Although improvements in the speed and accuracy of trade matching and registration systems have diminished such direct exposures to counterparties, the timing of substitution of the clearing house as central counterparty continues to have important implications for the distribution of counterparty risks between the clearing house and its clearing members.

As central counterparty to trades on the exchange, the clearing house is exposed to counterparty risks and it must establish procedures to control those risks. As will be discussed in greater detail in Section 4, a basic risk control mechanism and another common feature of clearing houses is restriction of access to the clearing process. Clearing members typically are a subset of the exchange members that usually must meet financial and operating standards that exceed regulatory and exchange minimums.[9] This structure of clearing houses creates the need for intermediary relationships between various participants in the clearing process; non-clearing exchange members must arrange for a clearing firm to assume financial responsibility for their trades and those of any non-members of the exchange for whom they execute trades. The clearing house has a principal-to-principal relationship with its members; the clearing house typically asserts that it has no legal relationship with the clients of its member clearing firms, including those clients that are exchange members.

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7 Annex 2 provides information on the structure of clearing arrangements for selected exchanges in each of the G-10 countries.

8 Among clearing houses in the G-10 countries, the only exceptions are the Tokyo Stock Exchange and the Osaka Securities Exchange.

9 As indicated in Table 2 of Annex 2, some clearing houses have several classes of clearing member that differ in terms of the types of party for whom they are allowed to clear.

3.2 Clearing members and their clients

Clearing members serve as intermediaries in their provision of clearing services to clients, which may include non-clearing exchange members or individuals or firms that are not members of the exchange. However, the nature of the legal relationship between clearing members and their clients is not always clear. In most cases the relationship between clearing members and their clients is also principal-to-principal, but in other cases it is characterised as an agency relationship. However, the implications of the legal relationship between clearing members and their clients are not clear in some jurisdictions or, at least, have not been tested in the relevant courts.

In most markets, tiered relationships that are often varied and complex have developed between the firms that provide clearing and the ultimate parties trading in the market. In the case of a trade by a non-member of the exchange (for example, a retail client), the clearing of that trade can take place through different paths (Exhibit 3). The retail client might choose to have its trade executed by a firm that also is a clearing firm; the trade might then be executed and cleared through that one firm. Alternatively, the retail client might desire to have its trades executed by a non-clearing exchange member. That firm would be able to provide trade execution services to the client, but it would have established a relationship with a member of the clearing house for the provision of clearing services. From the perspective of this clearing firm, both the retail client and the non-clearing firm are clients, and their accounts are afforded the client protections required in the market. (Client accounts of the non-clearing firm are often commingled and carried on the books of the clearing firm in what are known as omnibus accounts. Individual clients thus are not separately identified on the books of the clearing firm unless they are a direct client of that clearing firm.) Even more complex arrangements between firms and clients are possible. For example, a client might direct its broker to have the trade transferred from the broker's clearing firm to a different clearing firm that the client prefers.[10]

3.3 Money settlement procedures: the role of settlement banks

Another key element in the clearing arrangements for exchange-traded derivatives is a bank or a group of banks through which money settlements are effected. Settlement bank arrangements at selected individual clearing houses in the G-10 countries are described in Annex 3. Although the details vary considerably, two basic models can be identified: a central bank model and a private settlement bank model. The use of different models in different countries appears largely to reflect a combination of differences in financial industry structure and in central bank policies regarding access to accounts, hours of operation and provision of liquidity. Specifically, private settlement banks may be used because: (1) the clearing house or many of its members lack access to central bank accounts; (2) private settlement banks are willing to provide credit (especially intraday credit) to clearing members or to the clearing house in amounts or on terms (uncollateralised) that the central bank is unwilling to provide; or (3) the clearing house seeks to complete settlements with its clearing members earlier in the day than is possible under the operating hours and finality rules of the central bank payment system.

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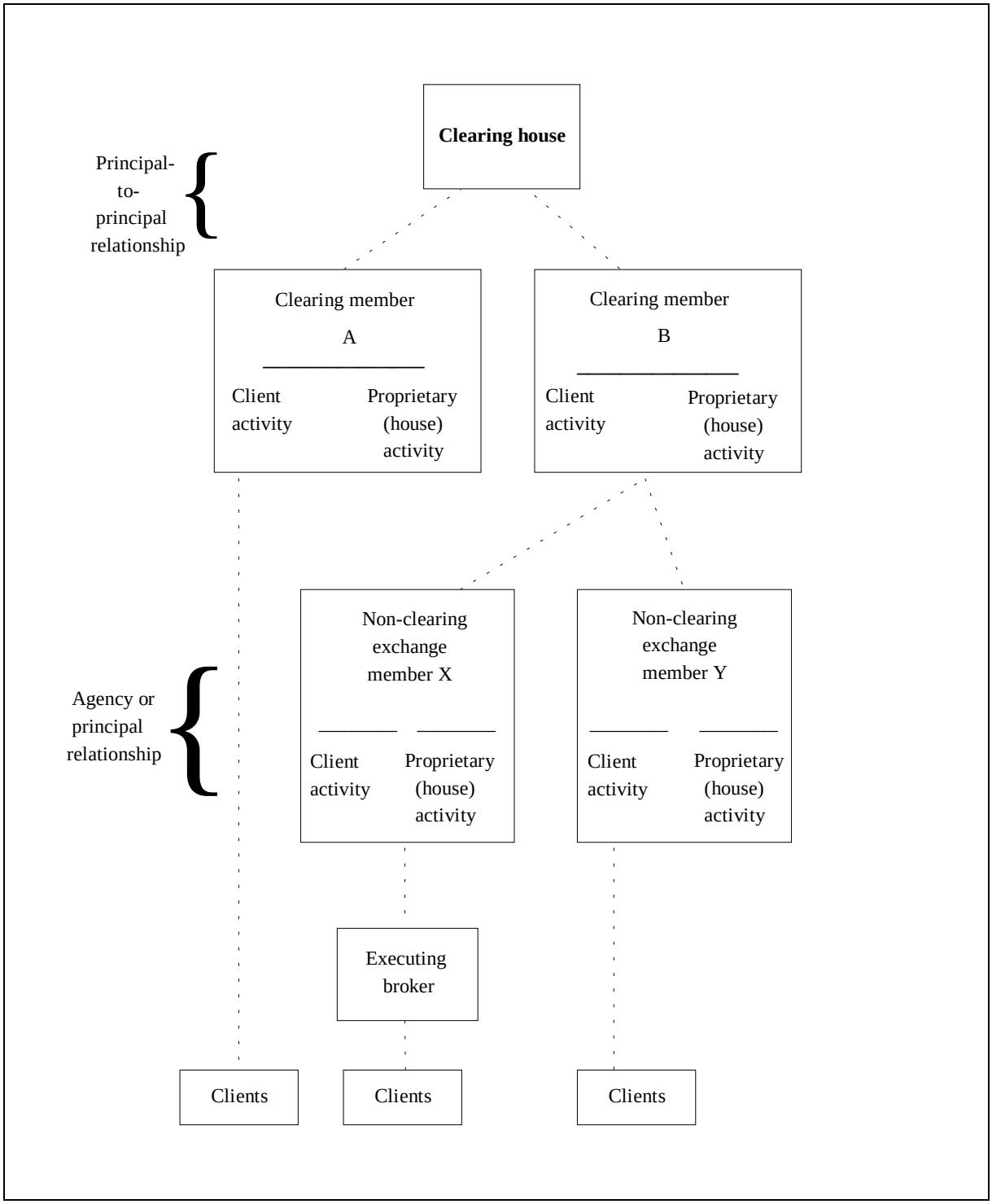
[10] Such transfers of trades between clearing firms (often called "give-ups") have become increasingly common as traders using multiple exchanges have often opted to hold their positions with a single global clearing firm while utilising multiple executing brokers to take advantage of their specialised knowledge and expertise regarding particular markets.

Exhibit 3

Relationships between the clearing house, clearing members, non-clearing members and clients



In the central bank model, money settlements between the clearing house and its clearing members are effected in central bank funds (top of Exhibit 4). Use of this model requires the clearing house and its clearing members to have access to central bank funds accounts.[11] In some countries, both the clearing house and its members are organised as banks, which ordinarily have access to central bank funds accounts. In some other countries, the clearing house or its members are organised as special types of non-bank entity but are nonetheless permitted access to accounts by central bank policies. But, in other countries the clearing house and most of its members are organised as non-banks, and central bank policies do not permit access for such entities.

In this model settlements can be effected only during the operating hours of the central bank payment system. Currently, most central banks operate their payment systems only during local business hours. In most cases transfers of central bank funds associated with clearing house settlements are final when effected. However, in some cases the central bank payment systems utilised are deferred net settlement systems that achieve finality only at the end of the day and could unwind transfers from a participant that failed to cover its net debit position.[12] In order to enhance efficiency in the settlement process, some central banks provide liquidity facilities to clearing houses or their clearing members. These facilities typically require the borrowers to post collateral or to enter into securities repurchase agreements. However, other central banks do not provide such liquidity facilities. The availability of liquidity from central banks often depends on whether the borrowers are organised as banks.

The other model for money settlements is the use of private settlement banks (bottom of Exhibit 4). In this model each clearing member is required to establish a banking relationship with one of a group of commercial banks specified by the clearing house.[13] The clearing house itself has an account at each of the settlement banks.[14] Settlements between the clearing house and its members are effected by transfers between their accounts on the books of each of the settlement banks. These transfers are typically final at the time they are effected, which is often early in the business day and prior to the earliest time at which the central bank payment system allows final transfers of central bank funds.[15,16] However, when multiple private settlement banks are utilised, transfers between settlement banks are usually necessary to balance the clearing house's accounts at each settlement bank. These interbank transfers are typically made through the national payment system and, therefore, cannot be effected until the payment system opens, and generally do not become final until the payment system achieves finality, which may not occur until the end of the business day (or, in one case, until the next business day).

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[11] In some clearing houses most clearing members have their accounts at the central bank, but others have only indirect access to central bank funds through banks with access to the payment system.

[12] Moreover, in some European countries, funds transfers are currently subject to a "zero-hour" rule that allows the unwinding of any transfers initiated by an insolvent entity after 00:00 on the date of its failure. However, a draft European Union directive on settlement finality would require countries to eliminate application of the zero-hour rule to payment systems and possibly also to securities settlement systems.

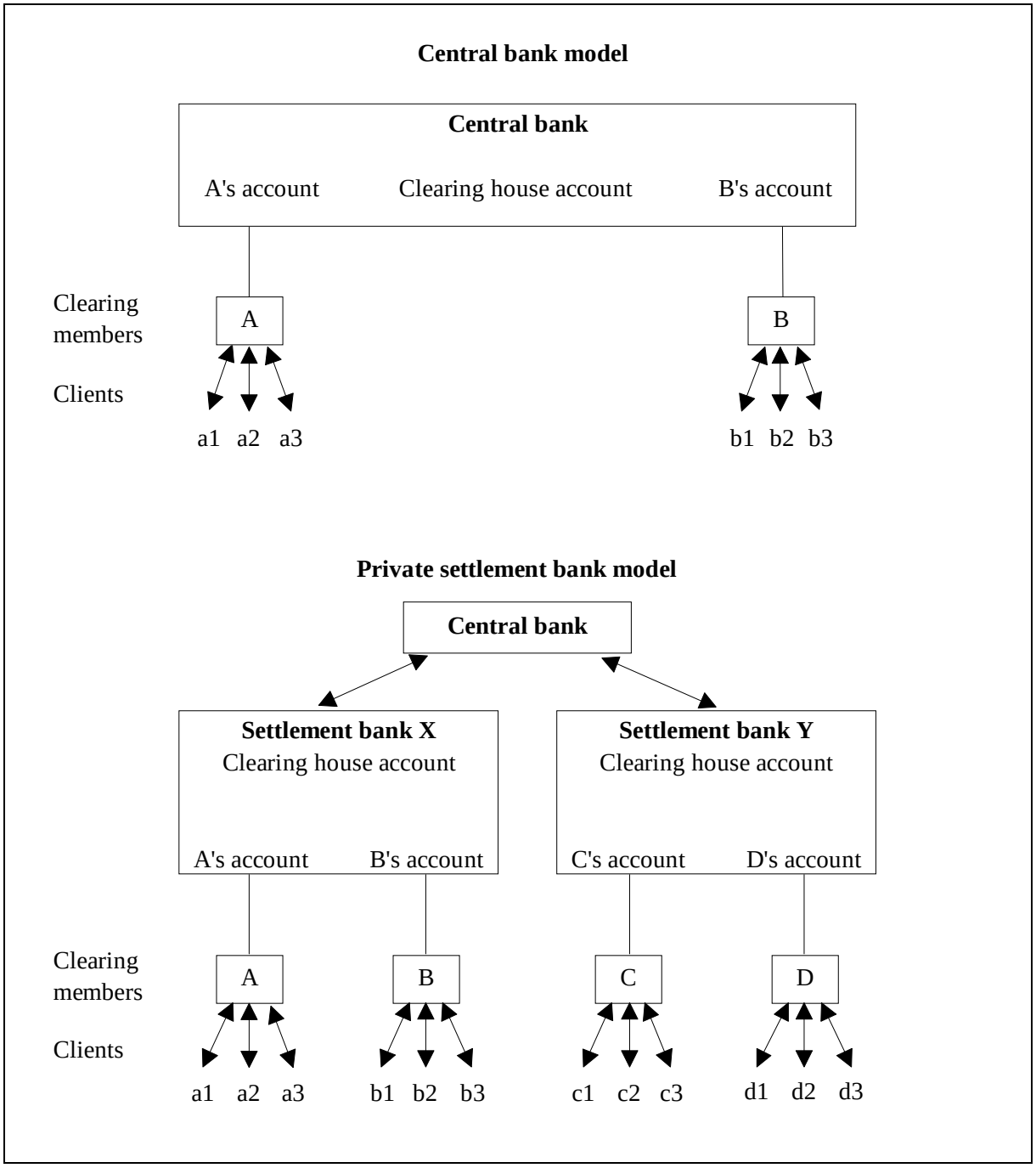
[13] In the case of the EOCC Clearing Corporation (Netherlands), all clearing members must establish a relationship with a single private settlement bank.

[14] In the case of OMLX, the London Securities and Derivatives Exchange, the clearing house has an account at some but not all of its settlement banks. The other settlement banks must arrange for interbank payments to be made to a bank with an OMLX account.

[15] Alternatively, in some arrangements settlement banks do not effect transfers on their books until after the opening of the national payment system, but make irrevocable commitments to effect the transfers.

[16] Here again, statements about finality of payments are subject to the caveat that in some jurisdictions all funds transfers from an insolvent entity are currently subject to a zero-hour rule.

Exhibit 4



Private settlement banks often extend intraday credit to clearing members, generally on an uncollateralised basis, especially in arrangements in which settlement occurs before the opening of the national payment system. In such arrangements, without credit from their settlement banks, the clearing members would be forced to incur the opportunity costs and credit risks of holding balances with the banks on the night prior to the settlement that were sufficient to cover their obligations to the clearing house.[17] Private settlement banks also often extend unsecured intraday credit to the clearing house by allowing it to overdraw its account in anticipation of a subsequent balancing transfer of funds from another settlement bank.

[17] In many cases members would not know the amount of their obligations until after the close of the previous business day. Consequently, without access to credit from the settlement banks, very large precautionary balances might be needed to ensure that adequate cover was available.

4. SOURCES AND TYPES OF RISK TO AN EXCHANGE CLEARING HOUSE

4.1 Overview

By substituting itself as the counterparty to trades, the clearing house assumes a variety of risks that must be managed. The clearing house typically assumes no market risk because, as central counterparty, for every long position it holds there is a corresponding short position, and vice versa. It is, however, exposed to the risk that one or more of its clearing members might default on their outstanding contracts. This exposes the clearing house to credit risks (replacement cost risks) and also to liquidity risks. Principal risks may also exist if contracts provide for delivery (rather than cash settlement) and if a delivery-versus-payment mechanism is not utilised to effect deliveries. In those cases in which clearing houses utilise private settlement banks rather than central banks to effect money settlements, another source of risk is the possibility of failure of a settlement bank. Clearing houses also typically maintain their own financial resources to help cover losses and ensure timely settlements, and the investment of such resources usually entails some risk of loss or illiquidity. Like other payment and settlement systems, exchange clearing houses face various operational risks. Finally, legal risks are also a concern; it is important, for example, that the clearing house's default procedures be supported in all relevant legal jurisdictions.

4.2 Defaults by clearing members

Replacement cost risks. If a clearing member were to default, the clearing house would face replacement cost exposure because the member's default does not relieve the clearing house of its obligation to the clearing member on the other side of the contract. The clearing house would generally replace the contracts by going into the market and purchasing or selling contracts identical to those on which the clearing member defaulted. The nature of the replacement cost risk that the clearing house faces varies from product to product. Derivatives exchanges list two basic types of contract: futures and options (including options on futures). A futures contract is essentially a standardised forward contract, that is, a contract that obligates one counterparty to buy, and the other to sell, a specific underlying asset at a specific price and date (the delivery date) in the future.[18] An option contract gives the buyer of the option the right, but not the obligation, to buy (a call option) or to sell (a put option) a specific underlying asset at a specified price (the strike price) on or before a specified future date (the expiration date). The seller of the option has an obligation to make delivery (a call option) or to accept delivery (a put option) at the specified price if the buyer chooses to exercise its right to buy or to sell.

Futures contracts initially entail no replacement cost exposure because contracts are struck at prevailing market prices. As time passes, however, prices will tend to move away from the level at which the deal was struck, and the clearing house will be exposed either to the buyer (if the market value of the contract decreases) or to the seller (if the market value increases). In other words, at inception a clearing house has no current exposures on futures contracts but faces potential future exposures vis-à-vis the buyer and the seller.

The clearing house's exposures on options depend on whether the buyer pays the premium upfront, that is, at the time the contract is executed (or shortly thereafter), and on whether the premium, if collected upfront, is passed through to the seller. If the buyer pays the premium upfront, it has satisfied its obligation to the clearing house and, therefore, the clearing house has no credit exposure to the buyer. If the premium is passed through to the seller, the clearing house is exposed to the seller for the amount of the premium, and its exposure to the seller will increase or

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[18] However, the substitution of the clearing house as counterparty and the imposition of various risk controls by the clearing house (to be discussed below) make the values and risk characteristics of futures differ from those of forwards.

decrease as the market value of the option increases or decreases. In other words, when option premiums are paid upfront and passed through, the clearing house has no exposure vis-à-vis the buyer, but has a current exposure at inception to the seller as well as a potential future exposure. On the other hand, if the premium is not paid upfront and passed through to the seller, the clearing house initially has no current exposure to either the buyer or the seller, but has a potential future exposure to both. If the market value of the option increases, the clearing house will be exposed to the seller; if it decreases, it will be exposed to the buyer.[19]

Liquidity risks. By substituting itself as counterparty to its clearing members, the clearing house exposes itself to liquidity risks; it must fulfil its payment obligations to non-defaulting members on schedule, even if one or more members default. Indeed, it is particularly critical that a clearing house perform its obligations without delay so that questions about its solvency do not arise. Depending upon the design of the clearing arrangements and the functions it performs, the clearing house may obligate itself to make a wide variety of payments: pass-throughs of profits on outstanding contracts, pass-throughs of option premium payments, reimbursements of cash initial margins, or payments for deliveries. In the event of a default, a clearing house would typically look to assets of the defaulting member and its own financial resources to raise the necessary funds. However, because clearing houses typically seek to minimise the opportunity costs of membership, in most cases few of these assets are cash assets.[20] Non-cash assets must be liquidated or pledged before the clearing house can meet its obligatory transactions, which may be difficult or costly to complete in the time required. Furthermore, for clearing houses that effect settlements in multiple currencies, foreign exchange transactions might also be necessary to convert the proceeds of such borrowings or asset sales into the required currency.

Principal (delivery) risks. Clearing houses can incur large credit exposures on settlement days, when the full principal value of transactions may be at risk. This can occur if upon maturity (futures) or exercise or expiration (options) contracts are settled through delivery and delivery versus payment (DVP) is not achieved. If a commodity or underlying instrument is delivered prior to receipt of payment, the deliverer risks losing its full value. If payment is made prior to delivery, the payer risks losing the full value of the payment. In some cases, the sequence in which deliveries and payments will occur is known in advance and principal risk is clearly asymmetric. In other cases, the sequence is not known in advance; indeed, even on settlement day the counterparties may lack real-time information on the status of deliveries and payments. Many products traded by derivatives exchanges call for cash settlement rather than delivery, and principal risk is thereby eliminated. These cash settlements are generally handled through the same channels as other cash payments. However, certain contracts that are settled through physical delivery - foreign exchange contracts in some G-10 countries and base metals contracts in others - have resulted in quite substantial deliveries in recent years. In these cases, where a DVP mechanism is not available clearing houses have used other techniques (prepayment, third-party guarantees) to limit the size of exposures or the risk of loss.

4.3 Settlement bank failures

As discussed in Section 3, clearing houses effect money settlements through one or more settlement banks. Clearing houses in some countries use the central bank as the sole settlement bank, which effectively eliminates the risk of settlement bank failure. However, clearing houses in other countries use private settlement banks and, therefore, are exposed to the risks of settlement bank failures. Such failures could pose both credit risks and liquidity risks to a clearing house.

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[19] However, the potential exposure to the buyer is limited to the premium, while the potential exposure to the seller is, in principle, unlimited.

[20] Those clearing houses that hold substantial amounts of cash typically reduce the opportunity costs to their members by paying interest on the cash balances. However, this requires the clearing house to invest the cash in non-cash instruments.

The size of the clearing house's credit and liquidity exposures to its settlement banks may be quite significant. However, whether this is so depends critically on: (1) the amounts owed to the clearing house by clearing members that utilised the settlement bank on the date of its failure; (2) the timing of the settlement bank's failure; and (3) the terms of the settlement agreement between the clearing house and its clearing members and settlement banks.

The amounts owed by clearing members in any particular money settlement at any one settlement bank depend primarily on the positions held by those clearing members and on changes in the market value of those positions.[21] In a particular settlement, a given clearing member may owe the clearing house money or may be owed money by the clearing house. The amount owed to the clearing house, if any, by a single clearing member can vary quite considerably from day to day. Moreover, because multiple clearing members use the same settlement bank, the total exposure to a settlement bank could far exceed the largest exposure to any single clearing member.

But, a clearing house would suffer losses and liquidity pressures from the failure of a settlement bank only if the failure occurred after the clearing house's account with the settlement bank had been irrevocably credited (and the clearing members' obligations to the clearing house were thereby discharged) but before the settlement bank had irrevocably transferred the clearing house's balance to another settlement bank. Even in those circumstances, the clearing house's legal agreements governing the use of its accounts at its settlement banks may significantly reduce or even eliminate the clearing house's exposures. For example, amounts owed to clearing members using a settlement bank may effectively be netted against amounts owed by clearing members to the clearing house. Or, the agreements may shift the risks of a settlement bank's failure from the clearing house to the other settlement banks that were scheduled to receive transfers from the failed bank in order to balance the clearing house's accounts.

4.4 Investment of clearing house funds

Clearing houses have financial resources (equity, reserves, other sources of funds) that are typically invested in order to generate revenues to partially offset the costs of clearing house operations. Clearing houses usually invest these funds in very short-term bank deposits or placements or in highly liquid, short-term securities. Thus, market risks on these investments tend to be negligible. However, the clearing house faces credit and liquidity risks vis-à-vis the banks with which it places funds and possibly also vis-à-vis the securities issuers.[22] In addition, securities investments may expose the clearing house to custody risks.[23]

4.5 Operational risks

Operational risk is the risk of credit losses or liquidity pressures as a result of inadequate systems and controls, human error or management failure. With respect to systems, the clearing house faces the potential breakdown of some component of the hardware, software or communications systems that are critical to its risk management system. Of particular concern is the breakdown of hardware that would impair the clearing house's ability to calculate money settlements, creating potential liquidity pressures both for itself and for clearing members. Breakdown of a key operational component could also heighten credit risks to a clearing house in at least two ways. First, it could

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[21] As noted earlier, money settlements cover a variety of obligations between the clearing house and its members.

[22] The securities purchased by clearing houses are often domestic government issues, which are essentially without credit risk.

[23] As will be discussed in Section 5, clearing houses impose initial margin (collateral) requirements to protect themselves from losses from clearing member defaults. If initial margin is posted in cash and the clearing house invests the cash margin, it faces risks similar to those faced when investing its own resources.

hamper its ability to monitor its credit exposures. For example, a breakdown in communications with an exchange's trading floor could deprive the clearing house of timely information on the open positions of clearing members or changes in the market value of such positions. Second, it could hamper the clearing house's efforts to control its exposures to its members. As already discussed, replacement cost exposures increase with the passage of time. Thus, any operational problem that delays settlement or prevents the clearing house from resolving a default can substantially increase the clearing house's credit risks vis-à-vis its members. With respect to human error or management failure, clearing houses are dependent on their staff to implement their rules and procedures. If the staff are negligent, the efficacy of a clearing house's risk management approaches can be compromised.

4.6 Legal risks

Clearing houses for exchange-traded derivatives may face a variety of legal risks that have the potential to substantially increase losses from a default, either by a clearing member or by a settlement bank. In the event of a clearing member's bankruptcy, perhaps the most significant is the legal risk that the multilateral netting arrangement between clearing members and the clearing house would not be upheld under the national law. Clearing houses in many jurisdictions have been afforded special legislative protection to ensure that their netting is valid. Another significant potential source of risk is that bankruptcy administrators might challenge a clearing house's right to close out (or transfer) positions and liquidate (or transfer) a defaulting member's assets.[24] Here again, national legislation often seeks to protect clearing houses from such challenges. However, as will be discussed in Section 8, when the defaulting participant has the bulk of its assets in a foreign jurisdiction, conflicts of law may arise that could cause difficulty for a clearing house. As another example, in the event of a clearing member's failure, a legal dispute might arise between the clearing house and a settlement bank over the finality of transfers (or the irrevocability of commitments to make transfers) between deposit accounts of clearing members and the clearing house. Likewise, in the event of a private settlement bank failure, legal disputes might arise between the clearing house and its clearing members or other settlement banks regarding the finality of transfers on the books of a settlement bank or between settlement banks. If the agreements between a clearing house, clearing members and settlement banks are unclear, it may be very difficult to determine who bears the risks of such defaults and failures and, therefore, these risks may be very difficult to control.

5. APPROACHES TO RISK MANAGEMENT

5.1 Overview

The primary purpose of this section is to describe the procedures typically employed by clearing houses for exchange-traded derivatives to manage two of the sources of risk that were identified in Section 4: (1) defaults by clearing members; and (2) failures of settlement banks. Approaches to the management of operational risks and risks associated with the investment of clearing house funds are discussed briefly at the end of the section. Certain legal risks that affect the risk of clearing member defaults or settlement bank failures will be mentioned in passing, but the Study Group has not attempted a thorough review of how clearing houses manage legal risks. Furthermore, the discussion of risk management primarily seeks to identify typical practices and important variants. It seldom refers to, and does not attempt to evaluate, the practices of individual clearing houses. Facts about risk management practices of individual clearing houses are provided in Annex 2.

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[24] The effectiveness of margin requirements depends on whether the collateral can be liquidated.

5.2 Risks of potential defaults by clearing members

As discussed in Section 4, a default by a clearing member would expose a clearing house to replacement cost risks and to liquidity risks. In general, a clearing house seeks to manage these risks by limiting the likelihood of defaults, by limiting the potential losses and liquidity pressures that would result should a default occur, and by ensuring that it has adequate resources to cover any losses and to continue to meet its own payment obligations on schedule. Although the details differ significantly from clearing house to clearing house, clearing houses in the G-10 countries typically employ the following types of safeguard: (1) membership requirements; (2) margin requirements; (3) default procedures that emphasise prompt resolution; and (4) maintenance of supplemental clearing house resources. In addition, risk-based position limits, that is, limits on the maximum size of positions held by any one clearing member in relation to its capital, are an important risk management tool in some clearing houses.

Membership requirements. The most basic means of controlling counterparty credit and liquidity risks is to deal only with creditworthy counterparties. Clearing houses typically seek to ensure that their members are creditworthy by establishing a set of financial requirements for membership. Usually clearing members are required to meet, both initially and on an ongoing basis, minimum capital requirements, often stated as the larger of a fixed amount and a variable amount that depends on some measure of the scale and riskiness of the firm's positions with the clearing house and in other financial markets. In most cases, membership is restricted to regulated entities that meet regulatory minimum capital requirements. Clearing firms that carry client accounts are often required to meet capital standards that are more stringent than regulatory minimum requirements. Of course, compliance with regulatory capital requirements does not by itself ensure that a firm can meet extraordinary demands for liquidity, including those that can be placed on clearing members by dramatic changes in prices of exchange-traded derivatives. Clearing houses typically do not impose specific requirements on clearing member liquidity (beyond those implied by capital requirements), but some clearing houses do periodically review their members' access to funding, especially their bank credit lines.

Information on compliance with regulatory capital requirements is often available only at discrete intervals, for example, monthly or quarterly. Given the considerable leverage and liquidity achievable through use of derivatives and other financial instruments, risk profiles of clearing members may change dramatically between regulatory reporting dates. For this reason, many clearing houses (or the exchanges for which they clear) conduct surveillance of members' positions on an ongoing basis. At a minimum, surveillance efforts cover activities on the exchange (or exchanges) for which the clearing house intermediates. However, the financial health of a clearing member generally cannot be accurately assessed without information on activities in other markets as well.[25] For this reason, exchanges, clearing houses and their regulators have been working to develop and expand information-sharing agreements with respect to common members.[26]

In addition to financial requirements, most clearing houses establish standards of operational reliability for clearing members. As will be discussed below, clearing houses typically impose tight deadlines for the submission of trade data and for completing various settlement

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[25] Reliable information on positions in other markets is essential if the clearing house lowers margin requirements or raises risk-based position limits when a member (or its clients) claims to hold offsetting positions in those other markets. Even when reliable information is available, such action by the clearing house may be imprudent unless it has a legally enforceable claim on gains from the offsetting positions.

[26] These efforts have been intensified since the Barings episode in February 1995. On 15th March 1996, 49 exchanges from 18 countries signed an "International Information Sharing Agreement and Memorandum of Understanding". To facilitate and augment the exchange agreement, on the same date regulators from 14 jurisdictions signed a "Declaration on Cooperation and Supervision of International Futures Exchanges and Clearing Organisations". By September 1996, six more exchanges and one more regulator had signed on.

obligations.[27] The failure of a clearing firm to meet these tight deadlines could significantly increase the clearing house's risk exposures to that clearing member and possibly to other clearing members as well. Compliance with operational deadlines is closely monitored on a day-to-day basis. Furthermore, in recent years many clearing houses have been paying greater attention to the backup systems that clearing members would have available if their primary operating systems were disrupted.

While a clearing house's membership requirements are an extremely important safeguard, they are not intended, and cannot be reasonably expected, to eliminate the possibility of a clearing member's failure. Capital requirements typically are not designed to cover potential losses from all possible price movements, and even the most comprehensive surveillance programme cannot be expected to detect, much less prevent, every incipient financial problem at every clearing member. Moreover, by creating highly concentrated exposures to a very small number of clearing members, extremely stringent membership requirements could actually increase rather than decrease the clearing house's risk.

Margin requirements.[28] In practice, clearing houses are able to permit fairly broad membership because the risk of losses from members' defaults is mitigated substantially by the use of margin requirements. All clearing houses impose initial margin requirements, that is, requirements to provide collateral (or guarantees) to the clearing house to cover potential future losses on open positions in both futures and options.[29] In addition, in the case of futures contracts, clearing houses nearly always impose variation margin requirements, that is, requirements that clearing members make periodic payments to the clearing house (and that the clearing house make periodic payments to clearing members) to settle any losses (gains) that have accrued on the clearing member's contracts since the previous variation settlement.[30] In the case of options contracts, while a few clearing houses impose variation margin requirements, most do not. In the most common approach, which is termed an "options-style" or "premium upfront" margining system, the buyer of an option contract is required to pay the option premium at the inception of the contract and is not required to post initial margin; the seller of the option receives the premium at inception and is required to maintain initial margin to cover the sum of the current market value of the option (initially equal to the premium) plus a cushion for potential future increases in the option's market value. By contrast, in a "futures-style" margining system, the buyer does not pay and the seller does not receive the premium upfront. Instead, as in the typical case for futures contracts, both buyer and seller are required to post initial margin and are required to make (or are entitled to receive) daily variation settlements.[31]

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[27] Most exchanges in the G-10 countries employ electronic trading systems, which obviate the post-execution matching of trade data. Nonetheless, even with electronic trading systems, clearing members often need to submit information on the allocation of trades to accounts and the resulting open positions.

[28] Clearing houses typically require their members to separate their house positions from their client positions and compute margin requirements separately. Furthermore, margin requirements for house and clients often differ in terms of the amounts required and the types of collateral accepted. These arrangements are described in greater detail in Annex 3, but in order to limit the complexity of the discussion and analysis, in what follows differences in the treatment of house and client positions, margins and funds are largely ignored.

[29] The term "initial" margin was chosen to describe this practice to achieve consistency with a recent report on margin requirements by IOSCO's Technical Committee (see Technical Committee of the International Organization of Securities Commissions (1996c)). However, it should be emphasised that this requirement must be met not only initially but as of every periodic margin settlement thereafter. In some countries what here is termed initial margin is referred to as "original" margin.

[30] The only exception involves futures contracts traded on the London Metal Exchange, which are cleared by the London Clearing House. The approach to margining LME futures contracts is sometimes referred to as "non-cash clearing", in contrast to the more common "cash clearing", that is, a variation margin approach. It should be noted that the non-cash clearing approach to margins is similar to options-style margining (described below), in that cumulative losses on open positions are collateralised (or guaranteed by third parties) rather than settled.

[31] Annex 5 illustrates the mechanics of the two types of margining system.

Both futures-style and options-style margining systems are designed so that in the event of a default by a clearing member a substantial portion of any losses on its positions could be covered by liquidating the margin collateral that it has posted. Futures-style margining periodically eliminates current credit exposures to clearing members through money settlements of any losses or gains arising from changes in market values of positions, while options-style margining collateralises current credit exposures to clearing members (the current market value of their positions). Both futures-style margining and options-style margining seek to collateralise potential future credit exposures to clearing members.

Regardless of whether futures-style or options-style margining is employed, the key determinants of the extent of protection against credit losses that is provided to the clearing house are: (1) the procedures used to determine the level of margin required, including the percentage of potential losses that the clearing house intends to cover and the reliability of the methodology it uses to estimate potential losses; (2) the price stability and liquidity of the assets accepted as margin collateral by the clearing house; and (3) the frequency of settlements of initial margin deficits (surpluses) and variation losses (gains).

Margin requirements are not designed to fully collateralise a clearing house's exposures to its clearing members in all market conditions. Rather, clearing houses seek to strike a balance between the risk reduction benefits of greater collateralisation and the opportunity costs that greater collateralisation imposes on their members. Faced with this trade-off, most clearing houses have tended to set margins at levels intended to cover from 95 to 99% of potential losses from movements in market prices over a one-day time horizon.[32] Clearly, a broader intended coverage will tend to provide a greater degree of protection to the clearing house. Equally important, however, is the robustness of the methodology the clearing house uses to measure potential losses from market price changes. A weak methodology could well produce coverage that is significantly less than intended. Use of a sound methodology has become increasingly important as options on futures have accounted for growing shares of total open positions on many futures exchanges. When options were first introduced, many clearing houses ignored the non-linear relationship between option values and changes in the value of the underlying asset, which tended to produce underestimates of potential losses on options positions, especially when the value of the underlying asset changed significantly. Moreover, they often used relatively simple and arbitrary rules to account for the potential for changes in the value of different contracts to offset one another (portfolio effects).

In recent years, most clearing houses have begun to assess potential changes in option values through the use of option pricing models which take account of non-linearities and also account for other sources of changes in option values, notably changes in the expected volatility of the price of the underlying asset, by performing full revaluations of option values at different values of the underlying asset and the underlying's volatility.[33] The use of option pricing models also allows portfolio effects to be assessed more precisely. Nonetheless, option prices can diverge significantly from model values, especially when the price of the underlying asset changes significantly. The more sophisticated clearing houses recognise this and make judgemental adjustments to model-based margin requirements, for example, minimum requirements for deep-out-of-the-money short option positions.

The types of assets accepted as margin collateral by a clearing house also affect the degree of protection against credit losses that is provided by its margin requirements. The assets

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[32] Because counterparty credit exposures on exchange-traded derivatives are determined by changes in market prices between settlements, the measurement of counterparty credit risks shares many common elements with the measurement of market price risk. Margin requirements are similar to the "value-at-risk" (VAR) estimates employed in market risk measurement in that the confidence limit, often 95 or 99%, and the time horizon, often one day, are critical parameters.

[33] Many clearing houses use methodologies developed by the Chicago Mercantile Exchange (SPAN) or by the Options Clearing Corporation (TIMS) or variants of one of these methodologies.

accepted typically include cash, short-term domestic government securities and, in many cases, some form of bank guarantees (for example, standby letters of credit). Longer-term government securities, other debt instruments and equities also are accepted fairly frequently, but the collateral value assigned to such securities is typically less than the market value by a percentage "haircut" that reflects the potential for the value of the security to decline.[34] In recent years, many clearing houses have begun accepting collateral denominated in currencies other than the currencies in which the exchange's contracts (and, therefore, the resulting payment obligations) are denominated. In such circumstances, additional haircuts may be applied to the asset values to reflect the potential for exchange rate changes to diminish the value of the collateral.

The last of the three key determinants of the degree of protection against credit losses provided by margin requirements is the frequency of settlements of initial and variation margin. Most clearing houses currently conduct one settlement each day. After the close of each trading day, the clearing house calculates initial margin deficits and surpluses, based on open positions as of the end of the day, and variation losses and gains, based on closing prices. Settlement of these obligations typically occurs early on the following business day, if possible before the opening of trading.[35] However, as will be discussed below, the funds (and securities) transfers associated with the settlements sometimes do not become final until later in the day.

In recent years, several clearing houses have introduced a second routine intraday margin call during the afternoon. Most other clearing houses have the authority to make intraday margin calls. In some cases, a margin call occurs automatically if market prices change sufficiently, for example, if a price limit has been reached.[36] Some clearing houses also have the authority to make selective margin calls, that is, to require settlement by some but not all clearing members, for example, only by those clearing members whose variation losses or initial margin deficits exceed some predetermined (and possibly firm-specific) threshold.

More frequent margin settlements clearly tend to reduce a clearing house's credit exposures. However, the extent of risk reduction depends on several key factors. The benefits may, in fact, be illusory if the settlements involve provisional rather than final transfers of funds to the clearing house. For example, multiple intraday margin calls may not produce any meaningful reduction of credit exposures if settlements are effected through a funds transfer system that could unwind, that is, rescind a transfer from a clearing member to the clearing house at the end of the day if the clearing member cannot cover its net payment obligation. Likewise, if initial margin deficits are met by transferring eligible collateral to the clearing house, such transfers do not effectively reduce risk unless they are final transfers. In the case of securities, for example, transfers in many settlement

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[34] Such haircuts may need to be quite large if the value of the collateral is related to the value of the positions which it is supporting in such a way that the collateral's value would tend to decline at the same time that the value of the positions decreases. For example, if a short position in a futures contract or a put option were supported by collateral in the form of the underlying asset, a very substantial haircut would need to be applied.

[35] However, many exchanges have introduced evening or night-time trading sessions, so further trading may have occurred since initial and variation margin requirements were last determined.

[36] Price limits preclude trading at prices outside the range specified by the limits. Many exchanges impose price limits on some or all of their contracts. From the standpoint of managing counterparty risks, price limits are, at best, a mixed blessing. On the one hand, by limiting potential price changes, they limit the size of variation settlements, and thereby limit potential liquidity pressures on the clearing house in the event of defaults by clearing firms. On the other hand, to the extent that market fundamentals imply prices outside the price limits, the clearing house may be exposed to additional credit losses, because variation settlement at the price limit allows some clearing members to satisfy margin requirements with payments that are less than the true economic losses on their positions. For this reason, some clearing houses reserve the right to base variation settlements on prices other than closing prices when price limits have halted trading. Of course, when variation settlements are based on other prices, potential liquidity pressures are not limited.

systems are provisional pending end-of-day net settlement of the associated money transfers.[37] Finally, the benefits are greater to the extent that the clearing house is able to incorporate in the calculation of margin requirements a larger share of trades that have been executed and matched since the last settlement. The clearing house's capacity to incorporate new trades depends, in turn, on the speed with which its systems can compute new estimates of open positions and can capture the latest market prices.[38]

While the degree of protection against credit losses provided by futures-style margining and options-style margining depends primarily on the underlying factors that have just been discussed, rather than on the choice between the two approaches, the use of options-style margining tends to reduce the vulnerability of a clearing house to liquidity pressures. In a futures-style margining system, at each settlement the clearing house must pay out to its members gains on outstanding open positions, while in an options-style margining system it pays out premiums collected as a result of new options sold. Ordinarily, the aggregate amount of such payments to clearing members is matched by the aggregate amount of receipts from clearing members. However, if a clearing member defaults, the clearing house would be faced with a shortfall of liquidity equal to the amount of funds owed by the defaulting clearing member. In general, the potential amount owed and, therefore, the potential liquidity shortfall would tend to be larger in a futures-style margining system than in an options-style margining system. Moreover, to the extent that a clearing house relies on liquidating margin collateral of a defaulting clearing member to cover liquidity shortfalls,[39] the amount of initial margin tends to be larger under options-style margining, because initial margin must cover current exposures (current market values) as well as potential future exposures.

In other respects, the determinants of potential liquidity pressures from a clearing member's default would be the same under futures-style margining as under options-style margining. In either case, more frequent settlements could reduce potential liquidity pressures from a default by reducing the amount of funds that need to be collected and paid out at any one settlement. However, if the funds transfers involved are provisional, the subsequent unwinding of transfers could place substantial liquidity pressures on the clearing house, especially if the clearing house does not learn of the unwind until late in the day.

Also, the capacity of the clearing house to meet liquidity pressures would depend, in part, on the liquidity of the margin collateral posted by the defaulting clearing member. Short-term government securities can ordinarily be sold quite promptly, either outright or under a repurchase transaction. But the same-day sale or financing of other securities may be difficult, especially in the turbulent conditions that may be the cause or consequence of a clearing member's default. As an alternative, securities might be pledged to secure bank loans. The liquidity of bank guarantees depends on how quickly the contract obliges the bank to provide the clearing house with funds in the event of a default. Even cash margin may not produce funds for a clearing house in time to meet liquidity pressures from a default if the clearing house has invested the funds. In general, the speed with which margin assets can be transformed into cash may depend critically on how quickly the relevant interbank funds transfer and securities transfer systems can achieve finality. If those systems are netting systems with end-of-day settlements, the clearing house may have great difficulty meeting an earlier deadline.

Default procedures. As has been observed, clearing houses typically base levels of margin requirements on a statistical analysis of potential losses over a one-day time horizon. The use of a one-day horizon implicitly assumes that a clearing house is able and willing to take action to eliminate its credit exposure to a clearing member within one day from its last settlement of any initial

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[37] See Committee on Payment and Settlement Systems (1992).

[38] As discussed in Annex 4, timely determination of open positions can be more difficult in gross margining systems because of the need to capture information on the effects of trades on gross open positions within the client account.

[39] As will be discussed below, some clearing houses rely more on their own supplemental resources.

margin deficits or variation losses.[40] In the event of a clearing member's default, typically its house positions would be closed out, that is, the clearing house would enter into offsetting trades on the exchange,[41] and the margin collateral supporting those positions would be liquidated as soon as possible. Alternatively, if the exchange was perceived to be temporarily illiquid, the clearing house would usually have the discretion to delay liquidation of positions to avoid further disruptions to the market and what may prove unnecessary liquidation costs. In the interim, the house positions might be hedged in other markets to reduce vulnerability to adverse price changes.[42] Most clearing houses would seek to transfer a defaulting clearing member's clients' positions and margin collateral to other non-defaulting clearing members.[43] Under the rules of a few clearing houses, however, clients' positions would be closed out and their margins liquidated, even if none of the clients had defaulted on their obligations to the defaulting clearing member.[44]

As discussed, most clearing houses conduct one routine margin settlement per day, based on positions and market prices at the end of the trading day. The funds transfers associated with the settlement are typically effected early the next day, although in some cases they do not become final until late the next day. In effect, a settlement of losses and margin deficits that arise because of changes in market prices and clearing members' open positions between the end of day T-1 and the end of day T are settled early on day T+1.[45] If final settlement occurs before the opening of trading on the exchange, a clearing member's default would become apparent within one trading day of the last margin settlement. If not, more than one trading day would have elapsed. In any event, a clearing house generally could not begin to close out a defaulting member's positions until after trading reopens on T+1, and this process could not be completed instantaneously. Thus, under the best of circumstances, a clearing house that conducts a single margin settlement each day would, in fact, need something more than one day to eliminate its counterparty exposures on positions that a defaulting clearing member had held as of the end of T-1.

The longer a defaulting member's positions remain open, the larger are the potential credit exposures on those positions.[46] Thus, a key issue is how quickly the defaulting clearing member's positions could be closed out. This would depend on the size of the defaulting member's positions and the liquidity of the markets in which they were held. To the extent that large open positions were held in illiquid markets, several days might be required. Furthermore, even if the markets in which the positions were held were ordinarily quite liquid, a default by a market participant, especially a large participant, could significantly reduce liquidity. Also, if the contract were subject to price limits, liquidation would not be possible as long as the limits were binding. In

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40 In this context, one day means one trading day.

41 In at least one case, however, open positions can be closed out by assigning the contracts to non-defaulting clearing members at off-market prices determined by the clearing house. In effect, such a procedure would constitute an assessment on the non-defaulting clearing members to which the contracts are assigned.

42 Of course such "cross-hedges" would involve some degree, perhaps a significant degree, of basis risk.

43 However, if the clearing member's failure was caused by defaults by one or more of its clients, client positions and margins may also be liquidated.

44 A recent report by the Technical Committee of the International Organization of Securities Commissions identified best practices for the treatment of positions, funds and assets. It concluded that: client positions of the defaulting firm at the market will preferably be transferred swiftly to other firms to avoid financial harm to clients, and to avoid spreading the damage from the default; in cases where the nature of the positions makes transfer impracticable, or in cases such as where the client has not completed the necessary documentation for the transfer or the applicable regulation does not allow for transfers, client positions may be liquidated in the market as swiftly as practicable, taking the potential market effect into account. See Technical Committee of the International Organization of Securities Commissions (1996a), p. 24.

45 As noted, some clearing houses routinely conduct an additional intraday settlement on the afternoon of day T, while most other clearing houses have the authority to do so.

46 As has been frequently observed in the context of securities settlements, "time [that is, delay] equals risk".

all these circumstances, the clearing house may have authority to hedge the open positions in other markets, but the hedges are likely to be imperfect at best.

Finally, the defaulting clearing member may have increased the size of its open positions since the last margin settlement. Because the last margin settlement on T would have been based on positions as of the end of T-1, these larger open positions could have been established at any time on T or, if final settlement on T+1 occurs after the opening of trading, earlier on T+1. Additional losses might result from closing out these positions, on which no initial margin would have been collected.

In sum, while margin requirements provide substantial protection to a clearing house, the preceding analysis has identified several reasons why the default of a clearing member could lead to losses that would exceed the value of the collateral it had posted with the clearing house to satisfy margin requirements. First, margin requirements are not intended to cover losses from all possible price movements, and the actual statistical coverage may be less than intended. Second, although margin requirements typically are based on estimates of potential losses over a one-day time horizon, if markets are illiquid or legal difficulties constrain the clearing house, more than one day may elapse before it can eliminate its credit exposure to the defaulting member, and while positions remain open, exposures can grow larger. Third, the defaulting member may have increased the size of its open positions since the last margin settlement.

Supplemental clearing house resources. Clearing houses recognise the potential for losses to exceed the value of a defaulting member's margin collateral, and maintain supplemental financial resources that are available to cover such uncollateralised losses as well as to provide liquidity during the time it takes to realise the proceeds of the defaulting member's margin assets. In most cases these supplemental resources are either assets owned directly or indirectly (through the clearing house) by the clearing members or contingent claims on the clearing members. Thus, utilising these resources has the effect of sharing (mutualising) uncollateralised losses among clearing members.[47] These resources can take many specific forms - capital and reserves, clearing guarantee funds (collateral pools owned by clearing members but under the control of the clearing house or cash deposited by clearing members with the clearing house in accounts separate from margin accounts), committed lines of credit arranged by the clearing house, insurance policies, guarantees provided by members, or authority to make assessments on members.

However, the size of such supplemental resources varies considerably from clearing house to clearing house. Moreover, the resources that are available may not be sufficiently liquid that they could be mobilised quickly enough to allow the clearing house to meet its obligations without delay. For example, assessments on members typically are not payable until a day or more after the clearing house makes a request. The liquidity of bank credit lines and guarantees depends critically on how promptly and reliably banks are obligated to make funds available. Even capital and reserves and clearing fund contributions are typically invested, and the investments may not mature, or, if salable, may not produce cash proceeds, until after (in some cases well after) the clearing house would need to make payments.

Position limits. Almost all clearing houses (or the exchanges for which they clear) impose some form of position limits, that is, limits on the number of contracts or the percentage of total open interest in a contract that a single client (or single clearing firm) can hold. In many cases, however, such limits are imposed primarily to inhibit the ability of market participants to manipulate prices, and they may not apply to contracts for which the deliverable supply is large or essentially unlimited or to positions that are considered non-speculative. As noted earlier, whether or not formal position limits are imposed, clearing houses typically monitor clearing members' positions, and they often have the authority to require reductions in positions if they give rise to prudential concerns. Some clearing houses integrate position limits into their risk management system more formally. For

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[47] By underscoring the potential losses to non-defaulting clearing members from a clearing member's default, the existence of such loss-sharing arrangements creates incentives for the clearing members to ensure that the clearing house imposes stringent membership requirements and margin requirements.

example, position limits for individual contracts may vary across clearing members, with the limit applied to an individual member proportional to its capital. In addition, some clearing houses limit the aggregate positions (across contracts) of individual clearing members to a specified percentage of capital. When position limits are more formally integrated into risk management, they are often termed risk-based position limits.

5.3 Risks of settlement bank failures

As discussed in Sections 3 and 4, clearing houses in some countries use the central bank as settlement bank, thereby effectively eliminating the risk of settlement bank failure.[48] Other clearing houses utilise one or more private settlement banks and may be exposed to significant losses and liquidity pressures should a settlement bank fail. Whether, and to what extent, a settlement bank failure would result in losses and liquidity pressures would depend on the amounts owed to the clearing house by clearing members using the settlement bank, the timing of the failure, and the clearing house's legal agreements with its settlement banks and clearing members.[49]

Among the approaches that clearing houses in the G-10 countries employ to manage credit risks and liquidity risks from the failure of a private settlement bank are: (1) the establishment of strict criteria for the choice of settlement banks; (2) the use of multiple settlement banks; (3) the use of other procedures that minimise the amounts and the duration of exposures to settlement banks; and (4) the maintenance of clearing house financial resources to cover any losses or liquidity pressures that might result from a failure.

The most basic safeguard against settlement bank failure is the selection of highly creditworthy banks. However, clearing houses appear to recognise that credit judgements inevitably are fallible and take further steps to limit their risks. In all but one case, clearing houses that employ private settlement banks use multiple banks. This tends to diversify the risks of settlement bank failure. However, the degree of diversification achieved will depend both on the correlations of failure probabilities between the various settlement banks and on the distribution among the different banks of clearing members and of amounts owed by those members. Moreover, as discussed in Section 3, when multiple settlement banks are employed, transfers of funds between the settlement banks are required. Completion of these transfers may not be possible until some time after the clearing house's accounts at the settlement banks have been credited for any amounts owed by clearing members. Such delays lengthen the duration of exposures to the settlement banks and thereby increase the clearing house's credit and liquidity risks. By contrast, when a single private settlement bank is used, if debits and credits to the clearing house's account are posted simultaneously, the clearing house's exposure is the net amount collected, if any, from all clearing members, which will always be less than or equal to the sum of its exposures to settlement banks when multiple settlement banks are used.[50]

When multiple banks are used, clearing houses may seek to minimise both the amount and the duration of their exposures to these banks through contractual means. Settlement agreements may provide that debits and credits to the clearing house's account at the individual settlement banks are posted simultaneously, thereby ensuring that the exposures are the net amounts, rather than the

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[48] As noted above, however, the use of central banks as settlement banks may increase the duration of a clearing house's credit exposures to its clearing members because of the limited hours of operation at most central banks and, in some cases, because central bank payment systems are still deferred net settlement systems.

[49] The legal agreements may shift the risks of settlement bank failure to the other settlement banks or to the clearing members.

[50] This is because of the more comprehensive netting of amounts owed by and owed to the clearing house on the single settlement bank's books.

gross amounts, owed by clearing members at each settlement bank.[51] They also may provide that balancing transfers between settlement banks are effected as soon as possible, thereby minimising the duration of the exposures. As noted earlier, the clearing house is exposed to settlement bank failure only if it occurs after its account at the bank has been credited and before the funds have been irrevocably transferred to another bank. Even in this case, however, the clearing house's agreement with its settlement banks may shift the risk of settlement bank failure to the non-defaulting settlement banks that were expecting to receive funds from the failed bank to balance the clearing house's accounts.

Finally, if despite these various measures a settlement bank failure should result in losses and liquidity pressures for a clearing house, it would seek to use its financial resources to cover those losses. However, as already noted, the size and liquidity of available clearing house resources vary quite considerably and may not be adequate to meet losses and liquidity pressures from a clearing member's default. Because settlement banks collect funds from multiple clearing members, the amount of risk in the event of failure of a settlement bank could substantially exceed the largest amount due from any single clearing member. Moreover, unlike the case of failure of a clearing member, no margin collateral would be available to offset losses from the failure of a settlement bank.[52]

5.4 Investment risks

Clearing houses face credit, liquidity and custody risks through investing their financial resources. They may also face these same types of risk from investing or safekeeping margin assets for their clearing members.[53] To limit their credit and liquidity risks, clearing houses usually establish standards for the creditworthiness of obligors and limit investments to relatively liquid or short-term instruments. Clearing houses seek to limit custody risks by carefully selecting the custodians whose services are used and by monitoring their performance closely. Diversification is also utilised to reduce risks - bank deposits are often spread among multiple banks and multiple custodians may be employed.

5.5 Operational risks

Clearing houses generally use an array of internal controls and safeguards to limit the various operational risks they face. In particular, clearing houses depend critically on the operational infrastructure - computer systems, communication systems, power sources and data feeds - that underlies their trade processing and risk management systems, and operational safeguards must address both availability and adequate capacity in each of these areas. Perhaps most fundamental is the clearing house's need to establish backup facilities for automation, communications and power sources. Clearing houses generally have off-site centres where data are stored and to which processing can be shifted within the day or within a few hours. Redundant power sources and communication lines are also common safeguards. Data security is important for clearing houses, both to prevent fraud and unauthorised use of information and to ensure that the information necessary for the completion of settlement is available. In order for markets to continue to function properly, it is important not only that the clearing house establish adequate operational safeguards, but also that

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[51] In some cases, however, a credit to the clearing house's account (and corresponding debits to clearing members' accounts) at an individual settlement bank is effected several hours before the clearing house's account is debited (and clearing members' accounts are credited).

[52] A clearing house usually has no right to use the margin assets of non-defaulting clearing members to cover losses or meet liquidity demands.

[53] These risks may be borne by the clearing house or by the clearing members and their clients directly.

clearing members take similar steps. Some clearing houses consider operational capabilities in their membership requirements and in their periodic examinations of member firms. Clearing houses also depend critically on qualified staff in order to avoid human errors that can compromise the reliability of even the most sophisticated systems. Hence, clearing houses seek to ensure that staff are appropriately trained and effectively supervised.

6. POTENTIAL WEAKNESSES IN CLEARING ARRANGEMENTS

The combination of risk management safeguards employed by exchange clearing houses has generally proved quite effective - in particular, there have been relatively few defaults by members of clearing houses in the G-10 countries, and none by settlement banks. Furthermore, in no case has the default of a clearing member significantly impaired the financial integrity of any of those clearing houses. Nonetheless, in several cases sharp movements in market prices have triggered events that raised doubts about the financial integrity of clearing houses, and in so doing, pointed to sources of vulnerability. For example, the collapse in US equity prices in 1987 triggered money settlements that were several orders of magnitude larger than clearing houses had previously experienced. Delays in completing these settlements triggered rumours about the financial health of the clearing organisations involved and may have exacerbated stock market volatility by widening the discounts at which some derivatives were trading relative to the cash markets. Another example is provided by the drop in Japanese equity values in early 1995, which triggered the collapse of Barings Plc and defaults by Barings entities that were direct participants in futures clearing arrangements in Japan and Singapore. Even in the Barings episode, the losses were apparently covered and obligations to other participants were met on schedule. Still, confidence in the financial integrity of the clearing houses was for a time shaken when unexpected delays were encountered in closing out or transferring positions and margin assets held by Barings and its clients.

More generally, analysis of the typical approaches to risk management suggests that clearing houses simply cannot be made fail-safe. With respect to the management of the risks of clearing member defaults, each of the safeguards typically relied upon by clearing houses has potential weaknesses and inherent limitations. To be sure, weaknesses in one safeguard may be compensated by strengths in other safeguards. For example, even if a clearing house's own resources are quite limited, there may not be cause for concern if it imposes very conservative margin requirements. Indeed, the failure of a single safeguard to perform as expected would generally not by itself imply credit losses or liquidity pressures that would be unmanageable. Nonetheless, certain events could simultaneously weaken several safeguards. One such event would be an extreme price movement that leads to an endogenous default of a clearing member, that is, a default that results from losses on house or client positions carried by the clearing member at the clearing house, rather than from losses from some other (exogenous) source. By hypothesis, such an event would produce credit losses that would not be covered by the defaulting participant's margins. It would also tend to strain money settlement arrangements, perhaps exposing hidden weaknesses. Another such event would be the failure of a clearing member that also is a settlement bank or liquidity provider. The remainder of this section discusses potential weaknesses relating to each of the typical safeguards and then considers the potential weaknesses in money settlement arrangements, weaknesses that can increase risks of losses and liquidity pressures from clearing member defaults or from settlement bank failures. It concludes with some further discussion of the events that appear to pose special dangers.

The effectiveness of membership requirements may be undermined by limitations of regulatory capital requirements and difficulties clearing houses may face in obtaining relevant information about the financial condition of clearing members. In recent years, both banking and securities regulators have devoted considerable attention and effort to strengthening capital requirements for market risks generally and especially for derivatives. The issues are quite complex, however, and the capital treatment of risks on open positions in options arguably remains less than

fully satisfactory.[54] In any event, like clearing houses, regulators typically do not seek to set capital requirements sufficiently high to protect regulated entities from losses from all conceivable market conditions. Furthermore, as noted above, even if capital requirements are effective in ensuring that losses are ultimately covered, they may not ensure that clearing members possess the liquidity needed to meet their obligations to the clearing house within the very tight time frames that are typically involved.

Even if compliance with regulatory capital requirements could ensure the solvency (or even the liquidity) of clearing members, reliable information on compliance is usually available only at discrete intervals, say monthly or quarterly. Given the leverage and liquidity provided by modern financial markets, the financial condition of clearing members can change radically between regulatory reporting dates. As discussed earlier, clearing houses typically recognise the potential for rapid deterioration in the financial condition of members and, for that reason, conduct ongoing surveillance of the condition of members. However, globalisation and financial innovation have made effective surveillance increasingly difficult. A clearing member's vulnerability to market price changes can only be evaluated on a portfolio basis, and the relevant portfolios often consist of related positions on different exchanges and in the OTC derivative and cash markets. A reliable analysis of the financial condition of clearing members requires information on all material positions, but information on positions in other markets that is both reliable and timely is often very difficult to obtain.

As noted earlier, both derivatives exchanges and their regulators have declared their intention to routinely share information on positions of common or related participants, including clearing members, but in many cases these intentions have not yet produced concrete agreements, in part because some clearing houses do not yet routinely collect information on large positions of clients of clearing firms.[55] Obtaining reliable and timely information on positions that are held in the OTC markets poses even more formidable challenges.

In the case of margin requirements, clearing houses face some of the same market risk measurement difficulties that regulators face. However, the limited range of products traded on individual exchanges allows the development of valuation and risk measurement models tailored to those specific products. In this regard, clearing houses were, in fact, pioneers in the application of option pricing models to the measurement of risk. Also, the time horizon over which risk is appropriately measured (one day or perhaps somewhat longer to allow for market illiquidity) is far shorter than the relevant horizon for regulators,[56] and risk measurement over longer horizons is

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[54] A particular problem is how to capture the non-linear responses of option values to changes in the value of the underlying asset. In the recent amendments to the Basle Capital Accord, for example, the quantitative standards for use of the internal models approach to capital requirements for market risk require that "banks' models must capture the non-linear price characteristics of options positions". But in the near term, a complete simulation of the effects of non-linearities does not appear to be required. Instead, national authorities will rely on "stress tests" to reveal weaknesses in options modelling techniques and have the authority to require more capital if significant weaknesses are evident.

Interestingly, some securities supervisors have made significant progress in measuring market risks on exchange-traded options by incorporating into capital standards the results of simulations of option pricing models developed and maintained by the exchanges' clearing houses. As discussed earlier, many clearing houses perform full revaluations of options portfolios to determine margin requirements.

[55] A recent report by the Technical Committee of the International Organization of Securities Commissions (1996b) discussed the purpose and structure of information-sharing agreements and surveyed the extent to which information on large exposures, defined as open positions sufficiently large that the clearing house would be placed at risk if the exchange member (clearing member or client) were to default, is currently available to market authorities (including clearing houses).

[56] For regulators the relevant horizon is that over which they can reliably detect and resolve an insolvency of a regulated entity. This arguably should be measured in months, not days. For example, the Basle Committee's internal models approach to market risk measurement sets out the goal of measuring risk over a ten-day interval, and then applies a

inherently much more difficult. Still, the risk measurement problems facing clearing houses are challenging. Option pricing models are, after all, only models, and market prices often diverge from model values, especially when options are far out-of-the-money. Furthermore, as exchanges trade an ever wider range of products, difficulties in aggregating measures of risk for different underlying assets become more important.[57]

Another important potential weakness relating to margin requirements is the fact that many clearing houses have only limited control over intraday exposures to clearing members, and none has real-time controls. As a result, a defaulting member could have substantially increased its open positions between the end of day T-1 and the morning of T+1, when margin requirements typically must be settled. Because most clearing houses agree to act as counterparty to all matched trades and trades are typically matched throughout the trading day, the clearing house is exposed to losses on the newly established positions, but has collected no initial margins to support them. To be sure, improvements in recent years in the speed with which clearing houses can match trades and compute open positions have enhanced their capacity to monitor this source of risk. Indeed, screen-based trading systems may permit real-time monitoring of positions and exposures. Furthermore, the authority to conduct intraday margin calls offers a mechanism for managing the risk. Nonetheless, some clearing houses still measure their exposures to clearing members only at the end of the trading day. Moreover, even with real-time position and exposure monitoring and intraday margin authority, sharp intraday price movements could still produce significant intraday exposures to clearing members.

Clearing house risk management systems implicitly assume that in the event of default the defaulting member's open positions can be closed out or transferred quite promptly. However, as already discussed, market conditions may not permit a prompt close-out of house positions (or, where necessary, client positions). In addition, operational and legal impediments to prompt resolution may be encountered. A recent IOSCO report emphasised the importance of contingency planning for a default, but some clearing houses may not have adequate plans, in part because they have never experienced a default.[58] Finally, the clearing house's efforts to promptly close out a defaulting member's positions and liquidate its margin collateral (or to transfer its client positions and margin assets) might in some cases be frustrated by legal regimes that seek to freeze the assets of an insolvent firm. If delays arise for any of these reasons, potential credit losses from a default increase.

Still another potential weakness is the possibility that supplemental clearing house financial resources are insufficient in amount or in liquidity to cover losses or liquidity pressures from clearing member defaults. The factors that produce a need for supplemental resources - the potential for extreme price movements, increases in open positions between margin settlements and delays in resolving defaults - are all extremely difficult to quantify. Moreover, clearing houses may not have procedures in place to even attempt to make timely assessments of the magnitude of these risks and their implications for the need for supplemental resources. Finally, clearing houses may be overestimating the liquidity of the resources they have. As already discussed, the value of margin assets of the defaulting member may not be realisable in time to be used to meet the clearing house's obligations. Likewise, if capital and reserves have been invested, delays could be encountered in realising their value; credit lines or bank guarantees may not require the banks to provide the funds until some time has elapsed; and assessments on members almost surely cannot be collected in time to help the clearing house meet its obligations on schedule.

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multiplier (a minimum of three) to the resulting estimate, in part to reflect the potential for losses to cumulate over a longer time horizon.

[57] The basic issue is the degree of correlation between changes in the values of the various underlying assets. Correlation estimates tend to exhibit temporal instability, either because the correlations vary over time or perhaps because correlation estimates are subject to substantial error.

[58] Technical Committee of the International Organization of Securities Commissions (1996b).

Clearing houses may also be vulnerable to weaknesses in money settlement arrangements that can increase their credit risks vis-à-vis clearing members or private settlement banks. These potential weaknesses have two basic sources: (1) the use of payment systems that entail the risk of unwinds of provisional transfers late in the day,[59] and (2) a lack of clarity regarding the obligations of various participants in the settlement process - clearing members, settlement banks and the clearing house - and how those obligations would be affected by the failure of a clearing member or private settlement bank.

Although central banks in the G-10 countries and in many other countries have implemented or are about to introduce real-time gross settlement (RTGS) payment systems in which funds transfers are final, that is, irrevocable and unconditional, when processed, in many countries today funds transfers are still netted and are provisional until all participants have covered their net debit balances. If any participant fails to settle its obligation, some or all of its provisional transfers of funds to other participants can be unwound. Those other participants could have difficulty coping with the resulting liquidity pressures, especially if the effects of the unwinds do not become apparent until late in the day, when money markets tend to be rather illiquid.

In the central bank settlement model, if the central bank payment system is a provisional net settlement system, the clearing house's exposures to a clearing member are not extinguished until the payment system achieves finality, which may be well after a provisional payment is received from a member. During the interval between the time a provisional transfer is received from a clearing member and the time it becomes final, exposures to the clearing member can increase as a result of changes in contract values and collateral values and new trades that increase its open positions. If the clearing member's failure only becomes apparent when the payment system attempts final settlement and if money markets are illiquid at that time, the unwinding of transfers to the clearing house from the failed clearing member may place substantial liquidity pressures on the clearing house.

In the private settlement bank model, the clearing house's exposures to its clearing members can be extinguished before the payment system achieves finality, provided that the settlement agreement specifies that transfers between the clearing members and the clearing house on the settlement bank's books are final. However, the clearing house's exposures to settlement banks generally cannot be eliminated until each settlement bank at which clearing members on net owe money to the clearing house has completed a final transfer to a settlement bank at which clearing members on net are owed money by the clearing house. Use of a deferred net settlement system increases the clearing house's credit risks vis-à-vis its settlement banks by lengthening the interval during which such surpluses are held by the settlement banks and, therefore, lengthening the interval during which the clearing house is vulnerable to loss should a settlement bank fail. Liquidity risks may also be substantial if an unwind of a transfer between settlement banks requires the clearing house to promptly cover the deficit of the settlement bank that received a provisional payment from the failed bank that was subsequently unwound.

Although a lack of clarity can be a weakness in any money settlement arrangement, it is perhaps especially likely to arise in the private settlement bank model because of its relative complexity. In either model, one question that must be answered to assess the risks to the clearing house from a clearing member's failure is when, and under what conditions, transfers on the books of settlement banks from clearing members' accounts to the clearing house's account become final. If the clearing house believes that a credit to its account is final when in fact it is provisional, it may seriously underestimate the potential losses and, especially, potential liquidity pressures from a clearing member's default. In the private settlement bank model, a proper assessment of the risks of settlement bank failures requires an understanding of when and under what conditions funds transfers between settlement banks become final. In this case, if a clearing house mistakes a provisional

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[59] Clearing houses that accept securities as margin collateral may face similar vulnerabilities if the securities settlement systems used are deferred net settlement systems.

interbank transfer for a final transfer, it may seriously underestimate the potential losses and liquidity pressures from a settlement bank's failure.

Individually, the potential weaknesses in the various safeguards that have been identified might not jeopardise a clearing house's ability to cover losses and meet its obligations without delay. But perhaps the greatest danger is posed by events that might simultaneously weaken several safeguards. One such event would be an extreme price movement, larger than that allowed for in setting margin requirements, that leads to an endogenous default of a clearing member, that is, a default that results from losses on house or client positions carried by the clearing member at the clearing house, rather than from losses from some other (exogenous) source. Price movements not covered by margin leave the clearing house with uncollateralised credit exposures to one or more insolvent clearing members. As knowledge of the default spreads, the exchange markets might become less liquid, especially if doubts were to emerge regarding the clearing house's financial integrity,[60] and the loss of liquidity would increase the time and resources needed to resolve the default. Finally, as was discussed in Section 2 and was illustrated in Exhibit 2, when prices on the exchange change dramatically, so too does the value of money settlements. This would increase the size of exposures to private settlement banks and would tend to bring to the surface any disagreements about the obligations of the various parties involved in the settlement process - settlement banks, clearing members and the clearing house.

Another event that could jeopardise a clearing house would be default by a settlement bank. This, too, could be an endogenous default if the settlement bank itself was also a clearing member and failed because of losses incurred on the exchange through proprietary trading or trading activities of its clients, including affiliated firms. Even if a settlement bank's default were not endogenous, it could be perilous if the bank was utilised by multiple clearing members which owed large amounts to the clearing house or if the settlement bank was also relied upon heavily as a guarantor of other clearing members or a provider of liquidity to the clearing house or many of its members.

7. WAYS TO STRENGTHEN CLEARING ARRANGEMENTS

The Study Group has identified various steps that clearing houses could take to reduce credit and liquidity risks vis-à-vis their clearing members and, where relevant, their settlement banks. In identifying these steps, the Study Group has focused on weaknesses that seem especially likely to result in losses or liquidity pressures that a clearing house might not be able to cope with and that, therefore, are potential sources of systemic problems. The analysis in the previous section pointed to several such potential sources of credit losses or liquidity pressures that could strain the capacities of even a well-designed and well-managed clearing house: extreme movements in prices of exchange-traded instruments; unwinds of provisional funds transfers to a clearing house or one of its clearing members; or the failure of a settlement bank. Given this perspective, the Study Group believes that the most effective steps that could be taken to reduce risk are: (1) the use of "stress testing" to identify and limit potential uncollateralised credit exposures and liquidity exposures to members from extreme price movements and to ensure that the clearing house's financial resources are of adequate size and liquidity; (2) enhanced intraday risk management through more timely trade matching and more frequent calculation of margin deficits, and development of the capacity for more frequent final settlements of margin deficits or variation losses; and (3) strengthening arrangements for meeting margin obligations by utilising payment systems and securities settlement systems that provide real-time or at least intraday finality of transfers and by eliminating ambiguities about the obligations of those involved.

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[60] Fears about the clearing house's financial integrity could become self-fulfilling if, for example, clearing members become reluctant to meet their obligations to the clearing house.

The Study Group does not mean to imply that systemic risk considerations require any individual clearing house to take any of the steps identified. At current levels of activity, existing safeguards may in most cases be adequate to ensure that the clearing house can cover any losses and liquidity pressures, even under extremely difficult market conditions. Furthermore, some of the steps identified, particularly those that are designed to ensure that potential losses and liquidity pressures from clearing member defaults can be contained, are clearly alternative means of achieving risk reduction, should that be deemed appropriate. Finally, in particular circumstances steps other than those identified by the Study Group might offer the most cost-effective means of reducing risk. Nonetheless, the Study Group believes that clearing houses should carefully consider whether implementation of the steps discussed below could produce benefits that exceed the costs. Public benefits in terms of reduced systemic risk would accrue from these steps, and it should be noted that each of the steps has already been taken by some clearing houses in the G-10 countries.

Stress testing. As discussed in Section 5, the typical approach to managing credit and liquidity exposures to clearing members is perhaps most vulnerable to defaults induced by extreme movements in the prices of contracts that the clearing house itself clears, that is, price movements in excess of the amounts the clearing house provided for in setting margin requirements. Clearing houses maintain supplemental financial resources to meet potential losses and liquidity pressures from such extreme price movements, but the magnitude of the potential pressures and the adequacy of those supplemental resources cannot be readily determined.

To do so requires stress testing, that is, the selection of extreme price scenarios and the estimation of credit and liquidity exposures that would result from their realisation.[61] The selection of scenarios may be based on historical data (for example, maximum historical price changes) or on statistical modelling of potential future price movements (and changes in implied volatilities of price movements). Whichever approach is taken, the choice of scenarios inevitably requires judgements about the possibility of future events that are simply unknowable. Once price scenarios have been chosen, their effects on contract values must be estimated. This may not be straightforward if the contracts cleared include options. An option pricing model must be utilised and, whatever model is selected, its ability to predict market values in market conditions that may lie outside historical experience is unclear.

Perhaps half the clearing houses in the G-10 countries currently have formal stress testing programmes. In some cases, the results are used to limit exposures to clearing members. If an estimated exposure is too large relative to the member's capital, the member may be requested to reduce its positions or to post additional margin collateral to support the positions. In a few cases these actions are mandatory and automatic. In addition (in some cases, as an alternative), clearing houses use stress tests to assess periodically the adequacy of the size and liquidity of their financial resources. However, in most cases those resources do not appear to be augmented automatically when the tests point to deficiencies.

Given their possible vulnerability to endogenous defaults stemming from extreme price movements, the implementation by clearing houses of routine and frequent stress testing has the potential to contribute significantly to addressing concerns about vulnerabilities in clearing systems for exchange-traded derivatives and about the potential for such vulnerabilities to create systemic problems. However, if these benefits are to be fully realised, it is important that the use of such tests

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[61] In addition to assessing the impact of extreme price scenarios, stress tests might also assess the potential for exposures to exceed margin requirements because of violations of other assumptions underlying their calculations, for example potential changes in implied volatilities of options or in correlations between the prices of different assets. For a general discussion of stress testing of estimates of potential changes in the value of a portfolio of financial assets, see pages 46-47 of Basle Committee on Banking Supervision (1996).

be accompanied by a commitment to limit exposures or to augment resources when necessary to ensure that the clearing house can cover the simulated losses and meet its obligations on schedule.[62]

Enhanced intraday risk management. As has been discussed, clearing houses typically conduct one routine settlement per trading day, usually on the basis of positions and position values as of the end of the previous trading day. Most also have the capacity to conduct one or more intraday settlements, either routinely or when large price movements have produced unusually large exposures. However, to date the benefits of these procedures have been limited in many cases by lags in receiving and processing information on intraday exposures and, in some cases, by reliance on payment systems and securities settlement systems that do not achieve finality until at or near the end of the business day.

Recent and prospective improvements in exchanges' and clearing houses' trade processing capabilities and in interbank payment systems and securities settlement systems are significantly enhancing the potential for clearing houses to reduce credit and liquidity exposures to clearing members by implementing more frequent calculation of margin deficits and variation losses and by developing the capacity for more frequent settlements of such amounts. Most clearing houses for exchanges employing screen-based trading systems have true real-time information on clearing members' open positions and variation losses, although not necessarily on initial margin deficits.[63] Likewise, many clearing houses for exchanges that utilise open-outcry trading have tightened deadlines for the input of trade details and have improved trade matching and processing systems to the point where the same information is available intraday and, in some cases, on nearly a real-time basis. Thus, most clearing houses are now able to monitor credit exposures and potential liquidity exposures to their members on an intraday basis, and some can monitor such exposures on a real-time basis.

Meanwhile, central banks in most of the G-10 countries have introduced or plan to introduce interbank payment systems that are RTGS systems or deferred net settlement systems that achieve multiple final settlements throughout each business day. The existence of such payment systems will allow clearing houses in those countries not only to monitor their exposures to clearing members on an intraday basis but also to actively manage those exposures on an intraday basis through the collection of variation margin.[64] Intraday use of securities collateral to cover initial margin deficits is also becoming possible in a growing number of countries, as more securities settlement systems have permitted final intraday transfers of securities from clearing members to the clearing house.

Such intraday settlements could be carried out routinely, perhaps at or near the end of the day, so as to reduce or collateralise the overnight credit exposures to clearing members that clearing houses typically bear today. Alternatively, intraday settlements could be made only in circumstances in which market volatility or surges in trading volumes produce unusually large exposures. Furthermore, settlements could be effected with all clearing members or only with clearing members to which the clearing house has significant exposures. By these means, the costs to the clearing house and its members of more active risk management could be minimised. For example, one clearing house is reportedly considering setting exposure limits vis-à-vis each clearing member as a percentage

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[62] In a different but related context, the need to take appropriate action in response to stress test results was recognised by the Basle Committee on Banking Supervision (1996), whose standards for the use of banks' internal models for determining minimum capital requirements for market risk required that "[stress test] results be reviewed periodically by senior management and ... reflected in the policies and limits set by management and the board of directors".

[63] Intraday computation of initial margin deficits in gross margining systems may be especially difficult, because it would require information on the effects of trading on the open positions of individual clients and such information is often available only at the end of the day.

[64] Where private settlement banks are used, this already is possible. Nonetheless, RTGS payment systems can facilitate the funding of margin calls by clearing members and can allow the duration of a clearing house's intraday exposures to private settlement banks to be reduced.

of the member's capital and calling for cash or collateral from a member on an intraday basis if, and only if, its intraday exposure to that member exceeds the limit set.

Such an approach, if based on real-time information on positions and position values, would come as close as is possible to achieving real-time control of credit and liquidity exposures to clearing members. However, for two reasons true real-time control of exposures simply is not possible. First, clearing houses usually do not have real-time control over a clearing member's open positions.[65] To achieve real-time control of positions, the clearing house would need to be able and willing to reject trades that increased open positions. As discussed in Section 3, some clearing houses are obligated to serve as counterparty to all matched trades executed on the floor of any exchange for which they clear. While others have the right to reject matched trades (in some cases until as late as the following morning's margin settlement), they may be quite reluctant to exercise this right, because doing so would force their clearing members to bear any counterparty credit losses on the rejected trades.[66,67] Second, even if a clearing house could achieve real-time control of a clearing member's open positions, real-time control of exposures on these positions would not be possible. Those exposures depend on changes in market prices, which ultimately depend on supply and demand. As already discussed, sharp changes in prices can result in sudden increases in exposure, which could increase further during the time that is allowed to meet an intraday margin call and the additional time that would be required to close out open positions in the event that such a call were not met.[68]

Nonetheless, with improvements in trade matching and processing systems and the availability of real-time payment and securities settlement systems, the size of potential losses and liquidity pressures from clearing member defaults can be reduced very substantially through intraday settlements. One further caveat should be noted, however. The implementation of intraday settlements will require clearing members to respond to settlement requests quite promptly. Also, should a clearing member fail to respond, the clearing house would need to mobilise its liquidity resources quite quickly to meet its obligations.[69] The introduction of new real-time payment and securities settlement systems will offer opportunities to clearing members and clearing houses to enhance significantly their capacity for meeting liquidity demands promptly. But they will need to be aware of the potential demands and take steps to ensure that they can take advantage of the new opportunities. Otherwise, more frequent settlement could, in fact, exacerbate rather than mitigate potential liquidity problems.

Strengthening money settlement arrangements. Clearing houses that currently use payment systems that are deferred net settlement systems can strengthen their money settlement arrangements as central banks implement new RTGS payment systems or extend the hours of

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65 By contrast, payment systems and some securities settlement systems achieve real-time control of the system's exposures to participants by routinely rejecting (or holding pending) funds or securities transfer instructions that would create an exposure in excess of a limit.

66 As discussed in Section 3.1, under exchange rules clearing members typically do not have the capability to manage counterparty credit risks vis-à-vis other clearing members.

67 A clearing house typically does have the authority to suspend a clearing member, which would bar further trading by the member and its clients but generally would not lead to rejection by the clearing house of trades executed prior to the suspension.

68 Market price changes can be temporarily limited by price limits or trading halts (sometimes collectively referred to as "circuit breakers"). While such limits would place an upper bound on the clearing house's potential liquidity exposures, they would not bound its credit exposures, because the clearing house may not be able to close out open positions until the price limits are lifted.

69 This assumes that the clearing house pays out as well as receives funds as part of the intraday settlement. This may not be necessary if a small amount of funds are being collected, but the collection and retention of a large amount might place substantial pressures on money markets and payment systems.

operation of existing systems.[70] Clearing houses that use the central bank as settlement bank will be able to reduce the duration of their credit exposures to clearing members. They will also be able to eliminate the spectre of unmanageable liquidity pressures from the unwind of a large payment by a clearing member late in the business day when liquidity resources would probably be very difficult to mobilise. Nonetheless, these clearing houses will need to review their ability to mobilise their liquidity resources quickly. To the extent that a clearing house relies on securities collateral for liquidity, the existence of securities settlement systems that allow final intraday transfers of securities should prove quite useful, and more such systems are likely to be implemented once RTGS payment systems are in operation.[71] To the extent that it relies on bank guarantees or credit lines, these agreements must require the banks to make funds available to the clearing house in time for it to meet its obligations without delay. Although RTGS payment systems should ease liquidity management by allowing more rapid mobilisation of funds, clearing houses, clearing members and banks will need to prepare to meet the intraday deadlines that will be part of an RTGS world.[72]

Clearing houses that use private settlement banks will be able to reduce the duration of their credit exposures to settlement banks and their vulnerabilities to severe and potentially unmanageable liquidity pressures from the unwind of a provisional payment from a settlement bank by using an RTGS payment system for balancing transfers among the settlement banks.[73] In fact, if each settlement bank at which clearing members on net owe the clearing house funds could be relied upon to instantaneously transfer those funds to a settlement bank at which clearing members are owed funds by the clearing house, the clearing house's credit exposures to settlement banks would be effectively eliminated.[74] However, the possibility would always exist that a settlement bank would fail to make a required transfer prior to its insolvency.

Like clearing houses that use the central bank as settlement bank, if clearing houses that use private settlement banks are to take advantage of the new opportunities created by an RTGS environment, they will need to review the adequacy of their liquidity resources and, if necessary, make changes to meet intraday settlement deadlines. They may also need to modify their settlement agreements to require the settlement banks to use the RTGS payment system to complete balancing transfers between settlement banks as soon as possible after final transfers from clearing members to the clearing house. The renegotiation of settlement agreements would provide an opportunity to review whether those agreements address obligations in the event of a default by a clearing member or settlement bank with sufficient clarity and, where necessary, to eliminate any existing ambiguities.

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[70] Even the implementation of deferred net settlement systems that establish multiple intraday processing cycles with finality achieved at the end of each processing cycle would allow clearing houses to significantly reduce risks.

[71] In the absence of a securities settlement system that provides intraday finality, a clearing house may need to identify lenders willing to accept the securities as collateral and pre-position the securities with those lenders.

[72] Clearing houses will also need to be mindful of the constraints on the availability of intraday central bank credit in the new payment systems. In many countries such credit will be made available only if the borrower has collateral that is acceptable to the central bank. At times of stress there are likely to be many competing demands for collateral, which may produce a shortage of collateral and delays in completing payments.

[73] This assumes that the central bank's RTGS payment system is operating at the time the clearing house seeks to settle.

[74] The clearing house may be owed more by clearing members than it owes to clearing members because, for example, of increases in initial margin requirements. If so, settlement banks receiving the surplus could be instructed to instantaneously invest the funds on the clearing house's behalf with an unaffiliated third party.

8. CROSS-BORDER ISSUES

The rapid growth of futures and options trading on organised exchanges over recent years has been supported by an increasing internationalisation of the markets and their clearing arrangements. The activities of most clearing houses now feature cross-border elements: many clear foreign exchange contracts or contracts based on foreign financial instruments; most have some clearing members that are units of foreign-based firms. Also, clearing houses now often accept collateral denominated in currencies different from that of the contracts being cleared, and some of this collateral may be located abroad. Finally, links have been established in recent years between clearing houses located in different countries. This section explains how these cross-border elements individually may make the management of the risks faced by clearing houses more complex and potentially more difficult and how combinations of them may compound the complexity and potential difficulty.

8.1 Contracts and collateral denominated in foreign currencies

Foreign contracts are broadly of two types: futures and options contracts based on a foreign interest rate, instrument (such as a government security) or stock index; and futures and options on foreign exchange rates, including those between two foreign currencies. Such contracts may be denominated in the local currency of the clearing house and collateralised with local currency assets; in such cases, settlements are effected in the same way as for domestic contracts. In other cases, contracts are denominated in, and money settlements are effected in, the currency of the instrument on which the contract is based. Regardless of whether the contracts are denominated in the local currency or the foreign currency, assets denominated in the foreign currency may be accepted as margin collateral.

When clearing houses conduct money settlements in foreign currencies, they sometimes use foreign currency accounts at domestic banks, which in turn depend upon their correspondent banking relationships abroad, to complete any interbank transfers on behalf of the clearing house. Alternatively, clearing houses may maintain accounts with banks located in the country of the currency's issue. Time zone differences and the need for banks to confirm receipt of payments by their correspondents abroad may result in longer delays before foreign currency payments from clearing members to the clearing house become final (or before the clearing house can determine that final payments have been received) than exist for domestic currency payments. Likewise, if the clearing house uses multiple foreign correspondent banks for a single foreign currency, the same factors may delay completion or verification of interbank transfers, thereby lengthening the duration of the clearing house's credit exposures to the correspondents.

When the clearing house accepts margin collateral in currencies different from the currency in which a contract is denominated, it would need to convert the proceeds through a foreign exchange transaction to meet the liquidity demands arising from a default. Depending on the time zones involved, a foreign exchange transaction for same-day value may not be possible. The consequent delay in obtaining the currency required would need to be taken into account in assessing the usefulness of such collateral as a liquidity resource and the adequacy of other liquidity resources available to the clearing house.

Finally, as with domestic contracts, settlement of a foreign contract by physical delivery rather than by cash may expose clearing houses to principal risk. In the case of foreign exchange contracts, the clearing house is potentially exposed to principal risk vis-à-vis its clearing members because of the lack of any mechanism to achieve simultaneous exchange of value in two currencies.[75] The clearing house may manage this risk by requiring clearing members to pre-deposit the currency due to be delivered to the clearing house or by requiring a guarantee from a settlement bank that the

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[75] See Committee on Payment and Settlement Systems (1996).

clearing member will make the delivery, thereby transforming its exposure to the clearing member into an exposure to the settlement bank. Contracts based on foreign instruments such as government securities may also expose clearing houses to principal risk if the settlement system for the foreign instrument is not a delivery-versus-payment system. If so, the clearing house may need to consider developing arrangements similar to those used to manage principal risks on foreign exchange contracts.

8.2 Foreign participants

The membership of most clearing houses includes units of foreign-based institutions. In most cases, such members are local subsidiaries or branches of a foreign institution; but membership without a local presence is possible in some G-10 countries.[76] Even where the clearing member is a locally incorporated subsidiary of a foreign company, the parent may in some cases provide a guarantee to the clearing house to cover the subsidiary's obligations.

From a clearing house's perspective, the key issue is whether it is depending on resources located outside its own jurisdiction to support the foreign-based member's performance of its obligations. If so, the evaluation of the member's financial capacity can become more complex. In principle, a clearing house can apply the same membership requirements to such foreign-based members as to domestic members. In practice, however, differences in the legal, accounting and regulatory arrangements applying in the foreign member's home country may make the application of those standards problematic. In particular, the extent and nature of home supervision of the foreign clearing member may be unclear, and, in some cases, there may be obstacles to the exchange of information with home-country regulators or market authorities. Together, these factors may make it more difficult for the clearing house to monitor the credit standing of the member (or its parent company if it provides a guarantee) and thereby to assess the risks posed by the member's positions at the clearing house. For example, the difficulties that clearing houses have in assessing whether a member has adequate liquidity resources to meet money settlement obligations resulting from sharp changes in market prices may be compounded for foreign clearing members. These firms' capital may be an especially poor indicator of their access to liquidity in the local currency.

Foreign membership may expose clearing houses to increased risk in the event of a default by a foreign member. In such cases, the foreign member, its liquidator or a creditor may seek to challenge the action of the clearing house in operating its default procedures. A liquidator may be able to obtain a ruling from a court in the jurisdiction of the defaulting member that the action of the clearing house was contrary to the principles of insolvency law in that jurisdiction. Whether the liquidator would also be able to enforce that judgement in the jurisdiction of the clearing house would normally depend, however, on whether the default procedures of the clearing house were open to challenge under local law.

Clearing houses seek to manage these additional risks in the application of their membership requirements and in their surveillance of foreign members' activities. They may seek to contain their legal risk in admitting foreign members by obtaining legal advice on potential conflicts between their own default procedures and the insolvency law in the jurisdiction in which the foreign participant is located. Clearing houses are also increasingly seeking to develop information-sharing agreements with foreign regulators and market authorities as well as with foreign clearing houses. Such agreements will allow clearing houses to obtain information related to the clearing member's compliance with its home-country regulatory requirements and the scale of its positions in other markets.

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[76] In the European Union, foreign participation may become more common as a result of the Investment Services Directive; this requires governments to ensure that firms authorised by another EU country to undertake certain activities, including derivatives activities, can become members of, or have access to, clearing and settlement systems for markets in their countries that are designated as regulated markets.

8.3 Collateral held in foreign jurisdictions

Most clearing houses hold some collateral - most often cash or foreign government securities - in foreign jurisdictions. When foreign government securities are accepted as initial margin, they are typically immobilised or dematerialised in the country of issue. A clearing house may hold those securities directly with a custodian in the country of issue or indirectly through a depository or global custodian located in the clearing house's jurisdiction or in a third country (e.g. Cedel or Euroclear).[77] Foreign cash balances are likely to be held in the home country, although holding eurocurrency deposits in the clearing house's own jurisdiction may be a feasible alternative.

Holding collateral in a foreign jurisdiction may expose a clearing house to additional risks in the event of a default of a clearing member. A liquidator may be able to obtain a ruling from a court in the jurisdiction in which the collateral is located freezing the assets held on behalf of the clearing house and preventing the clearing house from realising the defaulting member's collateral to meet any losses. This risk may be particularly acute where the defaulting clearing member (and its creditors) is incorporated in the jurisdiction where the collateral is being held. But it could also be a problem when the collateral is held in a third jurisdiction, for example that of a global custodian or clearing system. Holding collateral in a foreign jurisdiction may also pose operational difficulties: time zone differences may make it impossible for the clearing house to have immediate access in the event of a default.

Clearing houses seek to manage these risks by using custodians or other intermediaries to ensure that they have met the legal and other requirements necessary to establish their interest in collateral located abroad. Before agreeing to accept collateral located in foreign jurisdictions, they may obtain advice on whether the laws in those countries ensure that their interest in the collateral can be enforced. In some cases, clearing houses may require foreign clearing members to post collateral which is located in the jurisdiction of the clearing house.

8.4 Links with foreign clearing houses

As exchanges and their clearing houses have looked to cross-border alliances to boost trading volumes and to provide clearing members with secure and efficient means of trading and settling contracts in multiple time zones, several links between clearing houses in different countries have been developed and more are planned.[78] Links between clearing houses have taken two forms: clearing links and mutual offset systems.[79] In addition, exchanges may establish electronic trading links that do not involve a clearing relationship. As will be described below, clearing links and mutual offset arrangements differ in terms of the roles and responsibilities of the clearing houses. Selected examples of clearing links and mutual offset systems are listed in Exhibit 5. These arrangements should be distinguished from electronic trading links, in which positions in any one contract are held exclusively with one clearing house and its clearing members.[80]

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[77] The risks involved in settling cross-border securities transactions and in holding securities abroad via intermediaries are discussed in Committee on Payment and Settlement Systems (1995).

[78] The first major link was a "mutual offset system" established in 1984 between the Chicago Mercantile Exchange and the Singapore International Monetary Exchange.

[79] In practice, existing links are quite diverse and some do not conform neatly to either of the two forms identified here. Nonetheless, a distinction is often drawn between the two types and has analytical value.

[80] Globex, which for several years linked trading on MATIF and the CME, is an example of such a system.

Exhibit 5

Selected links between clearing houses[1]

Clearing house	Type of link	Products covered
BOTCC-LCH (planned)	Clearing link	US Treasury bond futures and options, German government bond futures and options[2]
CME-SIMEX	Mutual offset	Eurodollar futures, euroyen futures
LCH-TIFFE	Clearing link	Euroyen futures
LCH-SIMEX	Mutual offset	Brent crude oil futures
OM-OMLX	Clearing link[3]	All products traded on both exchanges
OM-OMLX-NOS	Clearing link[3]	Futures and options on Norwegian equities index (OBX), options on certain Norwegian stocks.[4]
OM-OMLX-SOM	Clearing link[3]	Finnish fixed income bond derivatives

[1] Acronyms for clearing houses are identified in Annex 2, with the exception of NOS (Norwegian Options Market), SIMEX (Singapore International Monetary Exchange) and SOM (Finnish Options Market). [2] Ten-year and five-year Treasury note futures and options to be introduced for trading in London; long-term UK gilts and Italian government bond futures and options to be introduced for trading in Chicago. [3] Trades in contracts covered by the link are cleared at the local clearing house of each counterparty to the trade and are not returned to a single clearing house. [4] Swedish equity-based products will be added.

Clearing links. These links involve a "home" exchange which is the primary exchange for the trading of the contract subject to the link (generally the exchange which introduced the contract) and an "away" exchange whose members may also trade the contract. The away clearing house assumes counterparty risk, but only for a limited time. It becomes the central counterparty to trades executed on its exchange until the positions are transferred to the home clearing house, generally at the end of each trading day. Before the positions are transferred, the away clearing house will typically make and receive variation margin payments based upon the difference between the trade price and the price at the close of trading on the away exchange. If the home exchange is closed, the away clearing house may also collect initial margin from its clearing members to manage its risks from products in the clearing link. Many of the products subject to clearing links are denominated in foreign currency (from the perspective of the away exchange). Clearing houses must generally make adjustments to their risk management procedures when money settlements occur in currencies other than the domestic currency. One such approach is to rely on commitments from settlement banks that they will provide the necessary funds on behalf of the clearing members when the payment system for the relevant currency opens. These procedures are similar to those used by clearing houses when they trade a contract that is not subject to a link agreement but is denominated in a foreign currency.

Positions transferred under a clearing link are assigned to clearing members of the home clearing house according to prior agreement. Once the position has been transferred, the home clearing house calculates additional variation margin based on the difference between the price at which the transfer was made and the settlement price at the home exchange. Positions are thereafter margined according to the normal requirements of the home clearing house. Deliveries and options exercises generally occur only through the home clearing house.

Mutual offset systems. In contrast to a clearing link, a mutual offset system allows participants to choose the clearing house with which the position will be held. Positions can be transferred between one clearing house and the other, and the transfer may result in each clearing house acting as a counterparty to a contract with one of its own clearing members and to an offsetting contract with the other clearing house. Both clearing houses in a mutual offset system clear the same contracts, and they are exposed to risks vis-à-vis each other arising from the institutional arrangements

that allow positions to be transferred from one exchange to the other. These institutional arrangements can involve the clearing houses becoming a special type of clearing member in each other's organisation. Thus, there is no longer a clear distinction between the two clearing houses in the services provided and the associated risks.

As part of a typical mutual offset arrangement, the clearing houses maintain accounts with each other holding equal but opposite positions. (The act of transferring a position from one exchange to the other means that the clearing house where the trade was executed now has a position at the other clearing house. Similarly, the second clearing house must become a counterparty to a position at the clearing house where the trade occurred in order for the clearing house where the trade occurred to have a long position for every short and vice versa.) The clearing houses must post initial margin with each other to cover the risks from holding these positions. These margin requirements are generally met with bank letters of credit. Also, a single bank account is typically used for variation margin payments between the clearing houses. This account does not always balance to zero, and overdrafts are subject to collateral requirements.

Risks unique to cross-border clearing. All clearing houses involved in cross-border clearing agreements face and must manage the risks that a clearing house faces in a domestic context. In addition, however, they face risks unique to these agreements. In a clearing link, the away clearing house guarantees the trades of its clearing members and faces the risk of default by a clearing member until the clearing member's positions are transferred. Moreover, a clearing house may also encounter problems either if the other clearing house seeks to transfer positions to one of its members that is in default or if it seeks to transfer positions to a member at the other clearing house that is in default. Responsibility for the trade and how the situation is resolved will depend on the detailed arrangements of the link. In a mutual offset system, the clearing houses are exposed to each other. Thus, each must be satisfied with the risk management safeguards at the other clearing house. Clearing houses in mutual offset systems are also exposed to the failure of the bank that they rely upon for making variation margin payments to each other. Finally, in both types of link, clearing houses face operational risks related to the technology supporting the link, including potential incompatibilities between the technologies used by the two organisations.[81]

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81 Operational risks from the technology supporting links also arise in trading-only arrangements.