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#1990-12



ISSUES IN FINANCIAL REGULATION

Working Paper Series

Payments System Risk Issues in a Global Economy

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FEDERAL RESERVE BANK
OF CHICAGO

WP - 1990/12

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I. Introduction

Financial market participants rely on the payments system to control risk arising out of the trading process. Market risk arises because a party to a financial contract may incur costs when seeking to replace a defaulted contract. The cost arises because the market value of the contract has changed. Delivery risk arises because one party may default after the other has already performed its obligations. By moving cash and collateral, netting payments, and facilitating settlement in a delivery vs. payment framework the payments system allows market participants to control these risks. Therefore, as financial transactions become increasingly international in scope, so too must the payments systems.

It is no longer appropriate to think in terms of an eight- or ten-hour business day at the end of which transactions stop and markets close. Today's financial markets function on a 24-hour basis and the mechanisms by which value is transferred need to keep pace. There exists significant concern by market participants and central bank staffs about whether or not this has occurred and, therefore, about the associated risks and costs involved with existing transfer and settlement methods. For example, as financial markets have matured, changes in payment practices which could improve the efficiency of the payments system have not been aggressively pursued. The main concern typically has not been with improving efficiency on the routine banking day on which asset prices change only slightly and market participants promptly meet payment deadlines on the various transfer systems. Rather the concern has been with the "exceptional" periods in which price swings are great and/or some participants encounter difficulty in meeting payment obligations. If the current payment procedures remain in place, payment volumes continue to grow, financial markets remain open longer and become more globally inter-

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twined, the fear is that the adverse effects during these "exceptional" periods may be substantial.

An abundance of evidence exists suggesting that world financial markets are indeed becoming more integrated and that U.S. domestic market transactions will increase during non-traditional hours in the future. For example, foreign currency trading has been growing at nearly 40% annually in recent years and shows little sign of slowing. Trading in international securities has grown even faster. Many market participants believe that the potential security lending business has only been scratched and activity will increase significantly in the future as a result of, among other things, the 1992 movement in Europe. International aspects come into play if either the cash or security leg of the transaction are not U.S. dollar denominated.

Significant changes which could lead to increased payments activity during non-traditional hours are also occurring in the derivative product markets. The customer base for U.S. based derivative products is significantly more international today than it was five years ago. Similarly, in recent years, foreign countries have developed competing exchanges on which U.S. customers desire to participate. The Philadelphia Stock Exchange and the Chicago Board of Trade have introduced nighttime trading hours, and the Chicago Mercantile Exchange is planning to introduce its GLOBEX system which will allow electronic trading during the U.S. nighttime hours.

Since financial and payments system activity are directly related, projected increases in global transactions will impact and may significantly strain existing payment systems. It is important that transaction technology and volume not significantly outpace payments system technology and procedures. Stated differently, it is important that the payments system not be a clog in the process of globalization.

In this paper we evaluate existing payment mechanisms used to initiate and settle financial transactions. We emphasize the need for these mechanisms to be capable of functioning on a 24-hour basis in the near future. We discuss the problems inherent in the current payment systems, and introduce and evaluate alternative policy options to address these problems.

The paper is organized as follows. In the next section we detail specific deficiencies in existing payment systems resulting from transfers of value driven by these transactions, and discuss various options to address the problems in Section III. Section IV examines the role of the Federal Reserve

in providing a mechanism for transferring value during non-traditional business hours. The final section summarizes our conclusions and offers policy recommendations.

Readers unfamiliar with the existing institutional structures and the problems inherent in existing payments systems may want to review the background material presented in the appendices. In the first appendix we discuss the risks involved with international financial transactions along with standard practices which influence the level of risk. Appendix II provides background on the existing payment systems used to initiate and settle international transactions.

II. Risks, characteristics, and deficiencies in existing payments systems

The global integration of financial markets is proceeding at a rapid pace. While financial instruments are increasingly being traded on a continuous basis around the world, payments systems have remained more parochial. The problems caused by this parochialism can best be appreciated by considering how clearance and settlement of obligations would occur in a world in which transaction costs were unimportant.

In this world, trades would be instantly transmitted to the clearance system. Any credit exposure due to market risk could be instantaneously eliminated through the posting of cash or collateral on a real-time basis. Any delivery risk could be eliminated through the use of delivery vs. payment mechanisms.

It is unlikely that this system will ever be achieved. Participants would incur considerable transaction costs in the form of wire fees, accounting costs, and forgone interest on cash balances. However, today's global payments system is further removed from this situation than many market participants find desirable. For much of the 24-hour day, elimination of emerging market risk through the transfer of dollar-denominated currency or collateral is awkward or impossible. In addition, delivery risk is substantial in many markets and the development of effective delivery vs. payment mechanisms to counteract this has not occurred and is unlikely. Problems in controlling risk are exacerbated by the absence of formal bilateral and multilateral netting agreements in most over-the-counter markets. Introduction of netting would result in a substantial reduction of delivery risk, although it would have little impact on participants ability to control market risk. However, this risk could

be better managed with the adoption of payment practices such as delivery vs payment arrangements.

This section details the payments problems that are currently emerging as a result of the rapid growth of cross-border trading of securities, interbank trading of foreign exchange rate obligations, off-shore clearing of dollar payments, and a shift toward 24-hour trading of derivative products. As these problems are analyzed, we attempt to reflect the likely impact of anticipated market changes such as adjustments to procedures on CHIPS (Clearing House Interbank Payments System) and the introduction of multilateral netting of foreign currency contracts.

International securities trading

Cross border secondary market trading of U.S. government securities has been growing rapidly. In 1988, trading by foreigners in these securities reached \$3 trillion; roughly \$12 billion dollars a day. Between 1986 and 1988 trading grew at an average annual rate of 22 per cent (Pavel, 1990).¹ In addition, trading in these securities by U.S. firms is now occurring on a 24-hour basis and is supported by off-hours trading of Treasury bond future contracts at the Chicago Board of Trade and LIFFE (London International Financial Futures Exchange). Aware of the expanding trading hours the Public Securities Association has recently announced a plan to disseminate pricing data on a 24-hour basis. While there are no good estimates of the volume of off hours trading of treasury securities, an analysis of futures trading data suggests that 15 percent of trades occurring during a 24-hour period take place during these hours. This would suggest a daily nighttime volume of U.S. government securities trading of approximately \$53 billion.

Although the current volume is much smaller, more dramatic growth rates have been registered in the market for private securities. Foreign transactions in U.S. bond markets currently approach \$300 billion per year and trading volumes have increased at an annual rate of 80 percent per year since 1982. Similar trends have been observed in other countries (see Table 1). In Germany, for example, the value of such transactions increased by 300 percent over the 1985-88 period to account for over half of the value of all transactions in German bond markets. Foreign bond transactions by U.S. residents reached an estimated \$380 billion in 1987, six times greater than the 1982 figure (Pavel).

Foreign transactions in U.S. equity markets grew at almost 50 percent annually to exceed \$670 billion in 1987 (see Table 2). Transactions by U.S. residents in foreign equity markets were about \$188 billion in 1987, nearly 12 times as much as in 1982 (see Table 3).

Crossborder trading in equity and debt instruments is clearly growing at a rapid rate. However, with the exception of crossborder securities lending and U.S. government securities, the growth in cross border trading is likely to create few demands on the global payments system that cannot be handled by existing institutions and arrangements. Participants in these markets typically have several days to complete settlement and to meet a margin call, thus, problems commonly involved with moving cash between parties in some financial transaction arrangements are generally unimportant in these markets. Indeed, because securities trades are generally netted, these markets account for relatively little international payment activity. For markets with a netting mechanism in place, the main problems involve the movement of paper based securities and the introduction of delivery vs. payment arrangements. Both of these problems can be ameliorated by the introduction of book-entry securities depositories. Even after implementation of the Group of 30 (1989) recommendations, settlement will occur over a three-day period making the timely movement of cash less important.² However, again, the two exceptions to the contention that payments evolving from securities transactions can be adequately handled with existing systems, involve the lending of securities to facilitate settlement and the delivery of U.S. government securities.

Discussions with a number of investment bankers indicated that it is becoming increasingly common for U.S. and foreign investment banks to borrow securities from U.S. institutional investors. Typically, these institutional investors are seeking to immediately reinvest the proceeds of the transaction in dollar-denominated assets and are not interested in maintaining a large number of overseas bank accounts. At the same time, neither the institutional investors nor the investment banks are interested in maintaining an unsecured credit exposure against the other for any period of time. Under the current system, securities lent to facilitate settlement in Tokyo are particularly troublesome since "good" or "final" dollars cannot flow into U.S. accounts until 5 p.m. the next day. Several firms indicated that these type transactions had grown from virtually nothing to significant levels in only two years. While there are no hard numbers, discussions suggests that payments arising from the settlement of these transactions could be as high as \$1 billion a day. The three day settlement deadlines for securities transactions proposed by the

Group of 30 could well accelerate the demand for such services as market participants are forced to rely more heavily on securities borrowings to meet settlement guidelines.

The current arrangements for settling transactions in U.S. government securities may also be failing to meet the needs of the international marketplace. Atypical for a market of its size, a large proportion of transactions in U.S. government securities are not subject to netting. Instead, most treasury securities are immobilized on the books of the Federal Reserve, and a large proportion of purchases are settled by a delivery vs. payment settlement process. The peculiar nature of the settlement process for U.S. government securities arises in part from the fact they provide a source of liquidity for financial and nonfinancial firms. This means that settlement procedures in the treasury market are focussed more on providing rapid availability than on minimizing transactions costs through netting. Because treasury securities are used as short-term investment vehicles, the growing importance of Treasury trading at night is also an indication of a growing demand for liquidity outside of traditional trading hours. Without the operation of a nighttime book entry system, the marketplace's ability to provide this liquidity may be limited.

Interbank foreign exchange markets

Based on the volume of transactions, foreign exchange (forex) trading is the largest single international financial activity. The Bank for International Settlements estimated that the 1989 daily turnover in the foreign exchange market was about \$650 billion and has been growing at approximately 40 percent annually (Pavel).

These foreign exchange transactions are initiated through informal, over-the-counter interbank markets. A relatively small portion of forex trades are subject to netting at initiation. However, significant position netting does occur at settlement as the relevant currencies are delivered through the pertinent payments systems.

Foreign exchange products--such as spot, forward, option, and swap instruments--specify a settlement or "value date" in the future at which the exchange of currencies will be completed. Spot exchanges are usually value dated one or two days from the initiation date. Forward, option, and swap transactions are value dated for longer periods, as specified by the transacting

parties. In most cases the market risk inherent in these products is not collateralized. Instead, risk is controlled by setting exposure limits to individual counterparties. The risks inherent in the foreign exchange markets have recently been exacerbated by the somewhat deteriorating creditworthiness of some of its participants. This deterioration can be detected in the bond ratings of large market participants, e.g., see Table 4.

Lack of netting

Today, most foreign exchange obligations are subject only to position netting. This occurs when final delivery instructions are entered into the relevant payments system (e.g., CHIPS for the dollar leg of a transaction). The absence of a netting by novation process is particularly troublesome since the largest participants enter into numerous transactions which ultimately offset one another. The resulting gross exposures are large relative to the participating bank's capital, exposing them to delivery risk. The fact that the net exposures are small means that much of the delivery risk could be avoided if netting by novation were implemented. Multilateral netting is particularly attractive since the large number of value dates, currencies, and participants can make bilateral approaches to netting relatively inefficient. In addition, since most participants deal with a wide array of parties, indirect credit risk is significant and a participant can find it extremely difficult to accurately assess its true exposure to other parties.

Netting schemes

The private marketplace took the first step toward netting foreign exchange transactions with the formation of FXNET, a bilateral netting by novation system that began operation in London in 1987. However, due to its structure as a bilateral system, transaction costs are greater than they would be under a multilateral netting procedure. Additionally, the system does not provide delivery versus payment. As a result, delivery risk is reduced but not eliminated. The major benefit of FXNET is that it could reduce transaction volume by an estimated 50 percent (Bartko, 1989). A reduction of this magnitude could lead to significant reductions in transaction costs and both liquidity and credit risks.

Simulations conducted by International Clearing Systems suggested that multilateral netting by novation would be even more effective; reducing delivery risk in all currencies by more than 83 percent, reducing market risk of near-term forward contracts by 70 percent, and long-dated forward

contracts by about 33 percent. Payment transactions, it was projected, would be reduced by more than 95 percent (Design Committee, 1989).

Market participants have seen multilateral netting schemes as a leveling influence which would reduce the advantage of those firms that have done the best job of evaluating and bearing risk. This has led some of the dominant firms to view these proposed schemes with suspicion. With a multilateral netting arrangement, losses are commonly proportioned based on a pre-arranged formula based on an individual firm's *total* trading with all parties in the exchange or clearinghouse. Thus, risk levels are controlled by prearranging strict trading group entry requirements and a frequent show-of-strength by group participants. This allows traders to view all counterparties as homogeneous. This approach has worked particularly well in the futures market where the clearinghouse stands in as the counterparty to all trades instead of the participant on the other side of the transaction, and the clearinghouses have enforced strict entry requirements and margin requirements.

However, what has worked so well for the futures market may not transfer to other markets. Conversations with investment bankers and large international bankers concerning the various netting proposals for forex activity suggests that some may be unwilling to "give up" control of individually evaluating and deciding on counterparties. Multilateral arrangements, it is argued, place firms in an undesirable position in which they cannot control or monitor counterparty risk. Thus, in spite of the projected cost savings, giving control of the risk management process to another entity is considered unacceptable. Recent proposals for the multilateral netting system attempt to address this problem by tying a party's exposure to the value of transactions it originated with the failing counterparty. In the event of the failure of a member of the clearinghouse, only those losses in excess of each originating party's capital would be mutualized. It is hoped that this procedure will maintain incentives for individual members to monitor and control risk and protect the competitive advantage of those members with expertise at risk analysis.

Lag between initiation and settlement

An additional problem with payments activity resulting from forex trades occurs because of the significant lag between initiation and settlement of these transactions. In today's markets, true spot transactions in foreign exchange are unusual and most transactions are settled 2 days after initiation. This occurs because few foreign exchange transactions are time critical. It has

been estimated that as much as 96 percent of foreign currency transactions are for market-making purposes (FRB-NY, 1989b; Table 44). The issue with these transactions is the ability to lock in profits; not to achieve immediate delivery. Most of the remaining four percent of transactions can be accounted for by the trading of corporate securities, which currently have a five business day settlement cycle; imports and exports, which are generally covered by long term contracts with predictable disbursement dates; and repayments of loans, which have predictable payment schedules. This basically leaves one type of transaction unaccounted for--trading in U.S. Treasury securities which do have a short settlement cycle. This suggests that the current two-day settlement cycle imposes relatively little cost on interbank participants, and, as a consequence, the demand for true spot transactions in the foreign exchange market is relatively small.

Lack of delivery versus payment

The absence of a multicurrency payment system requires parties to a foreign currency contract to deliver the respective currency payments over different payment systems. The resulting execution of settlement typically implies one party will deliver payment prior to the counterparty. The party making payment first is essentially extending credit to the counterparty and, thus, bearing the credit risk until payment is received. The elimination of this delivery risk would necessitate the simultaneous settlement by both transacting parties.

Netting arrangements reduce the importance of delivery vs. payment by reducing the magnitude of the payments due at the value date from the gross to a net amount. Multilateral netting obviously leads to greater reductions in delivery risk. However some multilateral netting arrangements are better suited to eliminating the need for delivery vs. payment procedures than are others. For instance, if yen-dollar transactions are netted separately from mark-dollar transactions, delivery vs. payment could be used to settle the different currency pairs at different times of the day. All that is needed to resolve this asynchronization is for the dollar clearing system to be open at the same time as the other currency's clearing system. However, if payments arising out of yen-dollar and mark-dollar transactions are all netted together, then all three payments systems must simultaneously be open to achieve true delivery vs. payment to completely eliminate delivery risk. While the logistics of a true delivery vs payment system make it unlikely to arrive anytime soon, there would still be an advantage to having payments to the clearinghouse being made at a time when all three systems are open. This

would make it possible for the clearinghouse to avoid paying one currency to a member which later fails to make another payment.

Summary- foreign exchange markets

The high rate of growth of foreign exchange trading would appear to make it an important factor in any decision to expand existing payments services. However, the introduction of multilateral netting will significantly reduce the delivery risk associated with foreign exchange trading. Studies have suggested that it could reduce the value of payments by approximately 95 percent, reduce volume on CHIPS by roughly half, and reduce delivery risk in all currencies by 83 percent. Multilateral netting clearly reduces the need for participants in the forex market to seek risk reduction through 24-hour clearing, or through the introduction of delivery vs. payment. However, should multilateral netting systems fail to develop, demand for improvements to existing payments services will increase.

Exchange-traded derivative products

Derivative products are financial instruments whose value is tied to an underlying instrument. Examples of exchange-traded derivative products include futures and options tied to Treasury bonds, Eurodollar CDs, the S&P 500 stock index, or the Japanese Yen. A futures contract is an agreement to buy or sell a commodity at a later date under terms designated by the exchange at a price determined today. Options contracts provide the owner with the right to buy or sell a financial instrument under the terms of the contract. The contracts are standardized with respect to the underlying commodity, the posting of initial and variation margin, the method of delivery, and the value date.

Globalization has spurred the creation and rapid growth of futures and options on internationally-related financial products including Eurodollar CDs, U.S. treasury bonds, and foreign currencies. Trading and open interest for Eurodollar CDs, U.S. treasury bonds, and foreign currency futures contracts have increased rapidly in recent years (see Table 5). Trading of futures contracts on Eurodollar CDs increased almost 70 percent annually since 1983 to reach over 25 million in 1988.³ Similarly, nearly 40 million futures and options contracts on various foreign currencies were traded worldwide in 1988, up from 14 million in 1983. Finally, trading of futures on U.S. treasury

bonds has increased from 16 million contracts in 1982 to 70 million in 1988 (Pavel).

Globalization has also lead to the establishment of futures and options exchanges worldwide. Once the exclusive domain of U.S. markets, particularly in Chicago, derivative products are now traded in significant volumes throughout Europe and Asia. Between 1985 and 1989 20 new formal exchanges were established, bringing the total number to 72 (US Exchanges, 1989). Obviously competition in this business line has increased as exchanges in London, Tokyo, and Singapore trade contracts that compete directly with those offered on U.S. exchanges. In addition, foreign membership at many exchanges is considerable. For example, over two-thirds of LIFFE's membership is based outside of the United Kingdom (Thagard, 1989). As a result of growth overseas, the share of exchange-traded futures and options volume commanded by the U.S. exchanges dropped from 98 percent in 1983 to about 80 percent in 1988 (Pavel).

U.S. derivative product exchanges are responding to the increased interest in round-the-clock trading as well as to the increased competition from foreign exchanges. The Chicago Mercantile Exchange and the Chicago Board of Trade have made plans to extend their normal trading hours through computerized systems. The Chicago Board Options Exchange (CBOE) is planning a 24-hour electronic trading system. The trading hours for foreign currency options on the Philadelphia Stock Exchange and Treasury Bond futures on the CBOT have already been expanded to provide greater overlap with the London and Tokyo business days.

Settlement procedures in futures markets

Derivative products markets control the credit risk created by the lag between initiation and settlement of contracts through the use of initial margin, variation margin, and loss-sharing arrangements.⁴

One or more times a day futures positions are marked to market. At this time losers are required to pay in cash to the clearinghouse a *variation margin* equal to the decline in the value of the contract. The clearinghouse, in turn, passes these payments on to the winners. The payment of variation margin eliminates any credit risk from the system and signals that participants are sufficiently sound to maintain their position and continue trading. Because winners and losers need not have accounts at the same clearing bank, interbank funds transfers are an integral part of the futures variation margin

process. Thus, the futures clearinghouses rely on a rapid, reliable electronic payments system to facilitate the transfer of variation margin with finality.

A futures clearinghouse also collects *initial margin* from each clearing member. Clearing members in turn collect initial margin from their customers. This margin is employed to guarantee that counterparties meet their contractual obligations to meet variation margin calls. Initial margin must first be posted in cash, however it may later be replaced with acceptable securities, cash, or standby letters of credit.

Settlement procedures in options markets

In options markets cleared by the Options Clearing Corporation (OCC), the clear distinction between variation and initial margin does not exist. When a short position is opened, a margin must be posted based on the current value and volatility of the option. The margin requirement is updated each day to reflect the opening and closing of positions as well as changes in the value of existing short positions. The process is similar to that employed in the futures market. First, payments to meet increased margin requirements must be made in cash and later replaced with securities or standby letters of credit. Second, short positions are marked-to-market daily. If the short position suffers a loss, additional payments must be made to the clearinghouse. If the short position gains, the clearing member's margin requirement is reduced, permitting it to withdraw funds from the OCC. However, unlike futures markets, the credit exposure of clearing members to the clearinghouse which arises from increases in the value of long options is not eliminated by a cash payment from the clearinghouse to the clearing member.

Since the options settlement process does not move funds from winners to losers, it is, in theory, less dependent on the payments system than are the futures clearinghouses. The value of payments to the OCC clearing members never exceeds the member's margin deposits and payments to the clearinghouse *could* be made with securities and standby letters of credit rather than cash. In contrast, the only way that a futures clearinghouse could execute a variation margin call without the payments system being open would be to have a single clearing bank. In reality, however, they are equally dependent since the OCC only permits securities and standby letters of credit to be posted after cash has been supplied.

Variation margin in a global market

Derivative product exchanges located in the U.S. are seeking to expand their customer base in East Asia and Europe and are rapidly moving towards 24-hour trading. Meanwhile, U.S. firms are making increasing use of products offered on foreign markets. These business development strategies will have a significant impact on the settlement process in the futures and options industry.

Most of the problems faced by the OCC *could* be dealt with by setting up overseas depositories, using standby letters of credit, and getting U.S. depositories to execute securities transfers 24 hours a day. The problem of effecting settlements during non-traditional banking hours is more complex for the futures clearinghouses and their clearing members. As business in Asia expands, the clearing members of these exchanges must confront the difficulties of levying cash variation margin calls on Asian customers during the U.S. business day. If the margin call is issued during Chicago business hours, the Japanese banking system is not open. Therefore, the only resources available to a Japanese customer are deposits and lines of credit with banking offices in the United States. Clearing members currently make up any customer shortfalls out of working capital until the end of the next U.S. business day. As the volume of business from the Far East increases, this intraday exposure due to the time zone differences may grow large relative to clearing members capital, making them less willing to continue this practice.

By increasing the expense of dealing with East Asian customers, the existing payments systems may be making it difficult for U.S. exchanges to further penetrate the Asian markets. However, interviews with a number of clearing members suggest that most foreign customers had U.S. balances arising from other activities that were large relative to their futures activities in the U.S. Where this was not the case, payments problems were typically resolved using foreign exchange services provided by the clearing member. Most clearing members seemed more concerned about the funds movements of U.S. customers dealing overseas than with the U.S. activities of foreign firms. This concern is derived in part from the smaller size of the typical U.S. customer, and in part from the deficiencies of many foreign payments systems and money markets.

Twenty-four hour trading creates additional problems for futures clearinghouses and their members. For example, it creates the need for intraday margin calls between 5:00 p.m. and 7:00 a.m. E.S.T.; a time during

which they are extremely difficult to execute. Such calls would be desirable since there is (or can be) substantial overnight price movement in a number of contracts--e.g., U.S. Treasury Bonds, Eurodollars, and foreign currency futures. Indeed, the yen-dollar contract experiences more price movement overnight than during the U.S. day (Lane, 1989). Therefore, for these contracts the ability to levy a nighttime margin call would be particularly useful. However, the margin call could be completed only if the relevant institutions (U.S. banks) were open during evening hours and had access to a means of transferring value. With additional trading during these hours, a clearing member would be exposed to additional risk commensurate with the additional time necessary to complete the margin call (i.e., additional time to confirm the customers ability to cover their positions).

It is conceivable that the derivative product market could function without the clearinghouses having the ability to levy margin calls and receive payments at night. However, large nighttime price moves would create credit exposures between clearing members. If the resulting exposures were large relative to the resources of the clearinghouse, trading would slow down and perhaps cease as clearing members became unwilling to bear additional clearinghouse risk. Trading would only resume once the existing credit risk had been eliminated as a result of the transfer of cash or securities from losing clearing members to the clearinghouse. Such a trading halt would be the market-based analog to a regulatory circuit breaker. Like its regulatory cousin, market-based circuit breakers would be a nuisance rather than a disaster. That is, payments and settlement could still take place. However, to the extent that such halts are the result of deficiencies in payments systems, market participants can be made better off by altering payment practices.

Delivery risk

Futures and options on foreign currencies also have delivery risk since contract delivery and payment do not occur simultaneously. This problem is similar, though smaller in magnitude, to that which exists in the interbank foreign exchange market.

Both the CME clearinghouse and the OCC employ devices to compensate for the lack of a delivery vs. payment facility for foreign currency transactions (e.g., see Chicago Mercantile Exchange, 1989; Ingber, 1987). Under the CME system clearing members bear two types of risk. The first is the risk that banks through which delivery is conducted will fail between the time that the seller and the buyer deliver their respective currencies. This window of

delivery risk has a duration of less than 24 hours and can be managed by choosing settlement and agent banks which are financially sound. The second source of risk arises due to market risk created by the lag between the expiration date of the contract and the delivery date. Initial margin deposits of the defaulting clearing member and the clearinghouse's guarantee fund are used to offset this risk.

Difficulty of margin calls in foreign currencies

All contracts currently offered by U.S. exchanges are dollar-denominated, as are the underlying margin deposits. However, a contract denominated in a foreign currency would require, at a minimum, that variation margin be settled in that currency. This is already the case in Eurodollar and Treasury bond contracts traded in London, Singapore, and Tokyo, and the Chicago Mercantile Exchange is contemplating listing a yen-denominated Nikkei stock index contract.

The problems faced by U.S. based customers trying to meet the yen-denominated margin call of a U.S. exchange, are similar to the problems of Japanese customers or clearing members trying to meet a dollar-denominated margin call during U.S. business hours. In both cases maximum efficiency can only be achieved if both banking systems are open. Because the spot market takes two days to settle (though one day lags are common when transactions involve currencies in the same time zone), trading parties would need to hold a reserve of the foreign-denominated currency. However, this could be a disincentive to trade the foreign-denominated contract.

Summary- exchange traded and over the counter derivative products

As the trading hours and customer bases expand in derivative product markets, the need to move margin monies around the world and around the clock will increase. This in turn will lead them to seek ways to execute variation margin calls outside of traditional business hours and across borders. While the critical pressure is likely to come from clearinghouses associated with exchanges, the growing collateralized over-the-counter market could also be a source of demand.

Offshore dollar clearings

Attempts to eliminate the risks inherent in current operating procedures for offshore dollar clearing arrangements, such as the Chase-Tokyo dollar clearing arrangement, may also lead to changes in payments system practices. For example, on Chase-Tokyo dollar transactions between Japanese banks are netted and "provisionally" settled through Chase during the Japanese business day, and settled in "good" funds through the accounts of the New York based Japanese branches via CHIPS at the end of the U.S. business day. Chase-Tokyo has many of the same risk control measures as did CHIPS in the late 1980s; i.e., restricts on participation, credit limits, and a deletion and unwind rule.

Numerous deficiencies exist with the current arrangements. Whether payments are actually "final" or not is open to debate. Although Chase has a loss-sharing arrangement in place, it may be able to settle selective accounts should funds from a particular creditor not arrive in New York. In most of these arrangements nothing dictates that the end-of-Japanese-day positions are legally final, although participants tend to behave as if they were. There needs to be an explicit agreement by which finality is guaranteed by the participating members. The allocation of credit and liquidity risk should be made explicit and be fully understood by all participants. Movement toward this goal has been enhanced by the Federal Reserve's policy statement on offshore dollar clearing arrangements (BOG, 1989).

Uncertainty of the precise procedures which would be utilized during a system crises is also a problem with existing offshore dollar clearing arrangements. For example, the failure of a participant in a debit position to make payment to Chase before the close of CHIPS could generate significant problems. Unless the defaulting participant failed during the Tokyo business day, the credit reversal under the deletion and unwind process would be unlikely. If the default occurred after the Japanese day ended, Chase would have already initiated irreversible credits on CHIPS and may have difficulty meeting its settlement requirements--therefore causing disruption on CHIPS. Alternatively, Chase could absorb the loss and could, during the next Japanese business day, request participants to reverse credits received the previous day. While small reversals may be made to maintain the Chase-Tokyo system, reversals of large positions during a time of crisis would be unlikely. Institutions would probably simply defer until more information were available on the defaulting participant. Therefore, temporal risk for Chase

resulting from "moonlight" overdrafts is significant since credit is passed some 14 hours prior to receipt of good funds in New York. This risk occurs as a result of the lack of an overlap between operating hours in the two countries, and the resulting void in any guaranteed means of transferring "good" dollars during the Japanese business day.

A new offshore dollar clearing arrangement based in Europe is also being considered by Chase Manhattan--Chase Net. Attempts are being made to learn from experience with the Chase-Tokyo arrangement and to introduce features to reduce firm-specific and system risk. Although it will still be a credit based system, credit limits will be imposed, there will be no unwinding of transfers, and the lag between initiation and settlement of positions will be significantly shortened.

III. Options for meeting the demand for nighttime transactions

Emerging stresses on the global payments system arise from several sources: the increasing importance of cross-border securities lending, the growth in the nighttime trading in U.S. government securities, the significant risk in the foreign exchange markets arising from the lack of netting or delivery vs. payment mechanisms, the rapid growth of offshore dollar clearings, and the attempt of futures and options exchanges to expand their trading hours and customer base. The level of pressure emanating from the foreign exchange markets will depend critically on what, whether, and how multilateral netting is introduced into this market.

This section reviews a numbers of options for addressing emerging global payments system issues with particular emphasis on alternative means of executing international dollar payments outside of traditional business hours. In discussing these options we focus on payments related to markets expected to generate nighttime activity, i.e., the treasury bond market, the securities lending market, the foreign exchange markets, derivative product markets, collateralized over-the-counter derivative product markets, and offshore dollar clearings. Performance is judged along three dimensions: responsiveness to user needs for risk reduction, payment system liquidity (likelihood of gridlock), and implications for central bank policy.

Since the level of risk resulting from payments activity during non-traditional U.S. banking hours is thought to be closely correlated with payment volume,

the need for and viability of the options considered are thought to depend critically on the level of activity in the nighttime market. Therefore, we preface our analysis of policy options with an estimation of the dollar value of these transactions.

Initial volume projections for nighttime transactions

The preceding discussion suggests that the initial volume of nighttime transactions will be generated predominantly from four sources:

- the treasury securities market,
- nighttime margin calls for futures and options markets,
- settlement of foreign exchange transactions, and
- off shore dollar clearing systems,

As noted earlier, there are no publicly available estimates of the volume of off hours trading in treasury securities. However, if we assume that the hourly ratio for nighttime trading of the cash securities is the same as for the futures contracts, then we can project that approximately 15 percent of total trading occurs at night. However, only a portion of these transactions are for same day settlement. Although no hard numbers exist, but the Federal Reserve rule-of-thumb is that about 50 per cent of transfer instructions received are for the settlement of trades made earlier in the day. Thus about 7.5 percent of the treasury transactions crossing the books of the Federal Reserve on a given day would arise from trades entered into the previous night for same day delivery. This suggests a daily volume of approximately \$26 billion.

In contrast, transactions from margin calls for futures and options contracts are likely to be relatively modest. For example, margin calls by the CME and OCC on October 19, 1987, an active market day by all accounts, accounted for approximately \$3 billion (Report of the Presidential Task Force, 1988). Discussions with several banks and clearinghouses suggest that on a typical day the derivative product markets create perhaps \$12 billion in payments traffic. However, only a portion of this represents movements of funds between clearing members and only a portion of these transactions would shift to night trading. Based on Chicago Board of Trade experience, nighttime trading constitutes about 15 per cent of daytime volume. Thus, we could

expect that payment of initial margins associated with the opening and closing of positions would approximate 15 per cent of the current daily total. Using the same source, average nighttime price movements for derivative products would be about 40 per cent of the total price movement over a 24-hour period. Assuming that the payment and collection of initial margin accounts for 30 percent of pays and collects over a typical 24-hour period, the demand for nighttime payments in the futures market could be as high as \$3.8 billion if customers were making payments at night. Rapid growth of the dollar-denominated contracts in London and Singapore could cause this to grow, as could a shift in variation margin practices of Japanese futures exchanges which currently give participants three days to meet a margin call on dollar-denominated contracts.

Payment flows related to the settlement of foreign exchange contracts are the most difficult to predict (see table 6). In the absence of a system of multilateral netting, contracts involving European currencies would probably settle at the close of the European business day (12 noon to 2 p.m. E.S.T.) and, thus, would not contribute to the U.S. nighttime volume. Similarly, movement toward a single monetary unit for Europe after 1992 could lead to reductions in foreign exchange activity involving these countries.

In the absence of multilateral netting, the primary source of nighttime foreign exchange transactions would be contracts involving the yen. The Bank of International Settlements (BIS) estimates that dollar/yen trading averaged \$162 billion a day in 1989. Of this, perhaps \$25 billion is netted away through offshore clearing arrangements. Thus, in the absence of any contract netting, dollar volume could average \$137 billion a day. However, netting is expected to occur. Introduction of bilateral netting on a currency pair basis could reduce the \$162 billion to \$81 billion. Since it appears likely that bilateral netting will continue to proliferate, this approximation should provide an upward bound on the demand for transactions.

The introduction of a multilateral foreign exchange clearinghouse could dramatically reduce the volume of payments associated with the settlement of yen/dollar transactions. International Clearing Systems, Inc. estimates that multilateral netting reduces dollar volume by approximately 95 percent, leaving us with a conservative revised total nighttime volume of about \$8 billion. However, existing multilateral netting proposals would net dollar payments associated with dollar/yen transactions against dollar payments associated with other foreign currency transactions. In this case, all currencies need to move at the same time to achieve any reduction in the remaining

delivery risk. Absent an adjustment in payments system hours in Japan or Europe, the logical time for this to occur would be early in the U.S. morning when the other two payments systems are open. With global forex trading currently running at \$650 billion a day, this would imply a projected forex-related dollar transactions volume of roughly \$33 billion dollars a day.

Finally, concerning our fourth source of demand for nighttime transactions, no accurate information exists on the dollar flows through offshore dollar clearing arrangements.⁵

Taking these sources of demand into account, the demand for nighttime transactions would run somewhere between \$30 and \$110 billion a day; depending on the assumptions employed (see table 7). The lower figure is comparable to the Federal Reserves 1968 electronic funds transfer volume, and approximately 2 per cent of current volume on CHIPS and FedWire combined.

If past growth trends are any indication, however, we can expect transaction volume to increase substantially in the future. Growth in trading of treasury securities by foreigners has been averaging 22 per cent a year. The gross value of all foreign exchange traded is growing at approximately 30 percent per year, while the gross value for the yen (the most important Far-Eastern currency) is growing at nearly 47 percent (FRB-NY, 1989b). Growth in open interest in major international futures contracts has been averaging approximately 24 per cent a year.

Several factors could contribute to greater than expected growth in the demand for nighttime dollar payments. They include:

- 1) The adoption of floating exchange rate regimes by newly industrializing countries such as Korea, Taiwan, and Thailand.
- 2) Accelerated growth in the open interest of dollar-denominated futures contracts due to the creation of new contracts and markets, as well as growth of open interest in existing contracts due to expanded trading hours.
- 3) Growth of an "Asian Dollar" bank and deposit market.

The point to be emphasized is that trading during the U.S. nighttime hours is growing rapidly, as is the associated risks resulting from existing payments systems.

How can this growing demand for nighttime payments services best be met? Below we identify seven options--three that are basically confined to the private sector, two involving direct public sector involvement in the provision of services, and two requiring international cooperation of governments. Private sector options examined include 24-hour intrabank transfers, a nighttime interbank payments system (NIPS), and a 24-hour money market mutual fund. Public sector options include Federal Reserve nighttime net settlement services, and nighttime operation of FedWire and SecuritiesWire. The options requiring international cooperation including central bank settlement of foreign currency transactions and a central switch for provision of delivery vs. payment for foreign exchange.

Private sector payments system options

Option 1- 24-hour intrabank transfers

Perhaps the best way to gain an appreciation for the nature of the global payments system problem is to consider a rather simple option of having individual banks transfer ownership of demand deposits or repurchase agreements within the bank on a 24-hour basis. Since nighttime transactions would only be made on an intrabank basis, banks would not need to buy or sell assets to fulfill payment instructions. Interest payments on repurchase agreements could simply be prorated. These deposits and/or securities could be moved into other accounts as soon as the traditional payments systems permitted.

This unilateral approach to initiating nighttime payments would enable participants to execute transactions 24-hours a day while involving only a few major players. It would not require any major regulatory changes. However, such an approach would be useless for moving funds between banks. As a result, it would provide no benefits to participants in the foreign exchange markets or offshore dollar clearing systems--where banks are in fact the principals. It would also have little if any impact on the nighttime market for U.S. government securities. The best that can be said for the unilateral approach is that it would partially alleviate problems faced by derivative product participants, and possibly facilitate cross-border securities lending.

However, as the following analysis suggests, it would actually do little for the derivative market participants.

Implications for derivative product markets- If intrabank transfers could be made on a 24-hour basis, it would at least be possible (if not easy) for derivative product exchanges to execute nighttime margin calls. This would make it possible to better control the credit risk inherent in a clearinghouse relationship. An exchange would designate one or more clearing banks and the clearinghouse and its clearing members would be required to maintain an account at each bank. Variation margin would be paid out of losing accounts into the clearinghouse's account, and be passed on to the winning accounts.

While this system would enable exchanges to make nighttime margin calls, there are several problems with it. First, customers would only be able to meet obligations to their clearing members if they had a bank account at a clearing bank. Second, unless balances were concentrated at a single bank, the system could encounter significant liquidity problems. These problems are analogous to those encountered when the banking system is closed due to a holiday while financial markets are open. Under this system, clearing members could be assured of meeting commitments only to customers that had accounts at each clearing bank. If customers held offsetting positions on different exchanges, and every customer and clearing member did not have an account at each clearing bank, they could find themselves extremely illiquid. This, in turn, could raise questions about the safety of the derivative product clearinghouses.

Finally, there would need to be coordination across clearinghouses to limit the total number of clearing banks. This would be necessary to keep transaction costs down, to maintain the liquidity of clearing members in light of offsetting positions at different exchanges, and to prevent clearing members from having to maintain a large proportion of assets in the form of bank balances. This could result in antitrust concerns.

Implications for offshore dollar clearing arrangements- With one exception, the intrabank transfer arrangement is essentially the process proposed by Chase Manhattan to offer a dollar clearing arrangement in Europe--Chase Net. Dollar transactions (mostly foreign exchange driven) initiated by participants during the European daytime hours would be netted and Chase would settle positions on its books early during the U.S. day. All the participants hold balances with Chase allowing it to settle positions using book transfers.

The only difference between the Chase Net program and the Intrabank Transfer option is that transfers may not be "final" on Chase Net in the sense that it is still a credit system. That is, although all participants hold balances with Chase they may be insufficient to meet their individual net positions. Thus, Chase extends credit to those participants in need. This example is raised to show that, in modified form, the option discussed is already being used for certain types of transactions. However, its usefulness to resolve payment problems across a wide array of transactions is relatively limited.

Option 2-- Nighttime Interbank Payment System (NIPS)

A more sophisticated private sector approach to resolving payment problems would be to create a nighttime interbank payments system (NIPS). This could entail the creation of a new clearinghouse or an extension of the current operating hours of private sector electronic payments systems--e.g., CHIPS or CHAPS. Like CHIPS and CHAPS, NIPS would probably be a credit based system. That is, the ability to overdraft would be set by counterparties. Only the final net settlement would involve a transfer of reserves. The system would presumably supply sender and receiver finality by utilizing loss-sharing and loss-control arrangements similar to those recently announced by CHIPS (Lee, 1989). With these provisions in place, NIPS payments would be nearly as "final" or guaranteed as those of a central bank.

To decrease temporal credit risk the system might wish to have an additional net settlement through its central bank at the beginning of the traditional opening of business. This would reduce the exposure of participants in their role as guarantors of NIPS payment messages. This important refinement will be discussed later.

Liquidity of NIPS- The liquidity of a credit-based nighttime payments system would be determined by the payments volume and the bilateral net debit caps. The majority of transactions on NIPS would be derived from two sources: settlement of foreign currency transactions and exchange-traded derivative products. With bilateral netting of foreign exchange transactions, it is likely that only yen/dollar transactions would be settled at night. We estimated that under a bilateral netting scheme, that initial NIPS volume arising from the settlement of yen/dollar transactions would be about \$81 billion per day. Without netting, volume was projected at \$162 billion per day. With multilateral netting of foreign currency transactions in place, it is not clear that there would be any place for NIPS in the foreign currency settlement process.

Whether or not a bilateral foreign exchange netting scheme is in place, it is doubtful that interbank liquidity would be a problem on NIPS for several years. As of summer 1989, peak daylight overdrafts on CHIPS averaged about \$45 billion a day (Board of Governors, 1989). Thus, if NIPS participants were willing to accept nighttime risks similar to their daytime exposures already incurring on CHIPS, they should be able to function without liquidity problems in the early years. Whether this would continue to be true in later years would depend on whether increases in the volume of trading lead to increases in net exposures.

Finality of NIPS- Numerous market participants will point out that because NIPS would be a credit-based system it would not be capable of offering the same absolute finality available on FedWire. This is incorrect. For these types of transactions there is nothing to prevent participants from adopting an unlimited loss-sharing arrangement or limiting the net debit position of receiving banks to a fraction of capital.

Impact on offshore dollar netting schemes- Since members of NIPS and their customers could initiate transfers in dollars at anytime, NIPS would be both a complement to and a substitute for existing offshore clearing systems. The new system would include a broader base of transactions, 24-hour access, greater liquidity, and enhanced finality due to the NIPS loss-sharing arrangement. By shifting business to this network, and offering enhanced finality, NIPS would reduce the temporal risk associated with existing offshore clearing arrangements. However, it is important to understand that NIPS may actually augment rather than substitute for existing offshore arrangements. By permitting offshore clearinghouse members to net payments arising at different points around the globe, offshore netting may actually become more important and temporal risk would still be significantly reduced.

Impact on interbank foreign exchange markets- NIPS would provide multilateral payments netting with a high degree of finality in a bilateral or gross transactions settlement environment. It would also widen the window for same-day spot transactions involving European currencies and open a window for transactions involving Japan. The benefits of NIPS in a multilateral netting environment are less obvious since the foreign exchange clearinghouse has already netted away any risk arising from offsetting transactions. For NIPS to be useful in a multilateral environment, there must be other transactions being entered on NIPS that offset the net positions from the clearinghouse. It is not clear that this would be the case.

Impact on derivative product markets- NIPS could solve most of the problems associated with nighttime margin calls by facilitating nighttime interbank transfers. The advantages over the intrabank transfer process discussed above would be significant. Since funds could be moved between banks, NIPS would reduce the need for clearing members and customers to be concerned with the distribution of idle balances across banks. Additionally, clearinghouses would not have to be concerned that funds paid out by one exchange would not be accessible to meet subsequent calls by a different exchange.

However, NIPS would not be a perfect solution. Because NIPS is a credit based system, there is some risk that the system would, when confronted with the failure of several participants, seek to unwind all transactions. However, if the something like the CHIPS loss-sharing arrangement is adopted such an event would have an extremely small likelihood.

Liquidity of the nighttime credit market, both at the customer and bank level, could conceivably be of concern to the exchanges and their associated clearinghouses. Payments transactions executed on FedWire during traditional business hours are supported by extremely liquid interbank and customer credit markets. The nighttime market may not be as liquid since there would be fewer participants, fewer liquidity sources, and perhaps a less sophisticated credit decision process. Absent other changes, this may occasionally result in a disorderly nighttime payments system. In periods of extreme uncertainty, payments might slow down because some banks would face binding overdraft caps. However, these problems most likely can be resolved by the participants themselves. One solution would be to permit larger overdrafts backed by collateral (this assumes that some sort of securities depository or book entry securities transfer system is open). Similar problems could arise at the clearing member or customer level as they may find credit difficult to obtain at night. Thus, exchanges that make nighttime margin calls may occasionally find customers facing more difficulty obtaining credit at night than they do during the day.

Implications for central banks- If CHIPS is any indication, NIPS would be extremely liquid. Careful design of the loss-sharing arrangement should provide additional stability to the system. Allowing participants to obtain larger bilateral credit caps by posting additional collateral would provide additional liquidity.⁶ Prior to the creation of the Federal Reserve, the New York Clearinghouse used a similar vehicle known as clearinghouse certificates to deal with heavy payments flows between members. By most

accounts the old interbank payments system functioned very well (e.g., see White, 1983).

In extreme circumstances, the system could gridlock. While it is not at all clear that central bank intervention would be desirable in such a circumstance, it could be accomplished if the central bank belonged to the clearinghouse and had the ability to initiate payment messages on behalf of other members. Such actions are unnecessary during the traditional business day since CHIPS operates in parallel with FedWire. Preapproved collateral and procedures for assigning it would have to be developed and, to be completely effective, the central bank would have to be free of any debit cap. Liquidity injections would then be the equivalent of a collateralized discount window loan. However, the availability of this last resort liquidity source could reduce the incentives of private sector participants to develop their own solutions to these problems. Therefore, an improvement over the daytime functioning of the discount window would be to have the Federal Reserve provide such credit at a penalty rate. This would encourage private credit solutions and would be more in line with the original intent of the lender of last resort function (Bagehot, 1962).

Option 3-- A 24-hour mutual fund

There are three potential problems with the NIPS approach. First, inflows of funds in a particular currency may not be investable until sometime during the next traditional business day. Unless the bank or the customer receiving payment is able to buy an earning asset the funds will not earn interest. This will be difficult if nighttime spot securities markets do not exist. Second, some participants may want *absolute* receiver finality while participating banks may be unwilling to offer such a service. A third potential problem is that membership in NIPS would probably be restricted to depository institutions. However, nonbank financial institutions may be more interested in conducting nighttime transactions than are the banks that service them. One way to alleviate these issues, while still providing for nighttime transfers of value, would be to employ a transfer system based on mutual fund shares rather than reserves.

This could be based on the prototype mutual fund recently proposed by Bankers Trust.⁷ Each fund would be denominated in a different currency and would hold short term debt securities to ensure marketability and liquidity. Share ownership could be transferred at any time at the current net asset value. A participant could obtain or dispose of shares through purchase or

sale for cash or securities, an exchange of shares, or by delivering or accepting delivery of eligible assets. In addition, Bankers Trust has proposed to provide an electronic bulletin board to facilitate trading of shares.

The ability to transfer ownership around the clock, combined with relatively stable net asset values would meet some of the needs of the derivative markets. It could also provide a vehicle to collateralize the risks arising from delayed settlement of offshore clearing systems, reduce the risks associated with crossborder securities lending by closing the gap between initiation and completion of settlement, and compensate to some extent for the current inability to deliver short-term treasury securities at night.

Liquidity- The 24-hour mutual fund is similar in concept to a central bank's real-time bilateral gross payments system with interest bearing reserves and no overdrafts. The liquidity of such a system is difficult to estimate and would depend in part on the demand by banks and customers for highly liquid investments with a transactions capability (i.e. the reserve base). However, the demand for such investments on the part of institutional investors is thought to be substantial. In June of 1989, institution-only money market mutual funds accounted for \$95 billion in assets. Bank holdings of nightly liquid assets are more limited. Estimates for the 40 largest commercial banks suggests that they hold only \$1 billion of treasury securities with maturities of three months or less and \$4 billion in interbank demand deposits. Estimates suggest that these same institutions hold an additional \$3.1 billion in treasury securities maturing in three to twelve months.⁸ The amount of balances banks and customers would be willing to hold in the 24-hour fund would obviously depend on the offered rate.

Two other factors will affect the liquidity of a 24-hour mutual fund used as a payments system. First, liquidity would increase with the willingness of participants to lend shares to each other--the mutual fund equivalent of a nighttime Fed funds market. Second, altering liquidity levels may be hampered if difficulties exist in changing the total number of outstanding shares outside of traditional business hours.

Finality- Finality on 24-hour mutual fund payments would be absolute. Like FedWire it would be immune to sender failure. Unlike FedWire it would also be immune to receiver failure since the securities in question have little if any price risk.

Implications for derivative product markets- The existence of such a mutual fund could be a valuable complement to a nighttime payments system if clearinghouses, clearing members, and customers were willing and legally able to use them as securities to meet initial margin requirements, or as cash equivalents to complete a variation margin call. Even if they were not, it would be useful if clearing banks were willing to treat shares as cash equivalents when committing to make variation margin payments for clearing members. Suppose, for example, that a clearing member is faced with a variation margin call that exceeds the balances available at his clearing bank. If the clearing banks or clearinghouses are willing to accept the mutual fund shares in lieu of cash, then additional balances could be obtained. These shares could either be owned by the clearing member or could be owned by a bank with whom the clearing member has a deposit or credit relationship. However, it should be emphasized that the usefulness of the fund as a vehicle or making margin calls will be tied directly to its degree of liquidity.

Implications for central banks- As detailed above, the liquidity of a payments system based on a mutual fund is likely to be somewhat more problematic than would the liquidity of NIPS. However, it is likely that transactions volume for the 24-hour mutual fund would be much lower than the volume on NIPS. Moreover, transactions in the shares of the 24-hour mutual fund would likely play a different role in the risk reduction process than would transactions on NIPS. While it is difficult to conceive of the circumstances, if gridlock were to occur the mutual fund structure may complicate attempts to resolve the problem. With NIPS the Federal Reserve Bank could liquefy a participant by guaranteeing a bank's payments message and collateralizing the extension of credit (assuming the Bank were a member). Such a credit extension would be similar to a discount window credit extension and should be provided only to solvent institutions. Under the mutual fund approach, the Federal Reserve could liquefy participants by transferring shares it held in the fund. Liquidity injections could occur as long as the Federal Reserve did not exhaust its holding of shares. Transfers could take the form of an outright sale of shares or a repurchase agreement. In the case of a sale, the purchasers reserve account would be debited. In the case of a repurchase agreement, the loan of shares would be collateralized. Once the Federal Reserve's shareholdings were exhausted, further transfers could occur only if the Federal Reserve borrowed or bought shares from other participants. In this case the Federal Reserve would generate liquidity by acting as a guarantor of intraday credits and not through its traditional means of reserve creation. Alternatively, the Federal Reserve could be permitted to commit Treasury securities to the fund in exchange for additional shares.

Federal Reserve unilateral payments system options

The preceding options have a common feature--the Federal Reserve has a limited role in the daily operation of the nighttime payments system. This section examines possible nighttime roles for the Federal Reserve.

Option 4--Additional net settlement services for private clearinghouses

Like its daytime counterpart, NIPS would ultimately settle through the Federal Reserve. Other types of nighttime clearing houses, for instance a multilateral foreign exchange clearing house, might also seek to perform a final settlement across the books of the Federal Reserve. In order to reduce the temporal risk associated with NIPS settlement, the Federal Reserve could offer net settlement services outside of traditional hours. Thus, NIPS transactions, for example, could be settled at or before the current beginning of business on FedWire. This would probably require minimal additional operational expenses for the Federal Reserve, would enable banks to use the fed funds market to obtain sufficient liquidity for settlement, and would allow lender of last resort services to be offered at settlement time. Most importantly, it would cleanse the system of temporal risk which currently remains until the end-of-day CHIPS settlement. It should be emphasized that this approach is not novel. Japanese transfer networks currently allow for multiple settlements during the day.

Implications for the effectiveness of NIPS- The provision of additional net settlement services would affect the foreign exchange and derivative markets to the extent that they would affect the performance of NIPS and the offshore clearinghouses wishing to settle through NIPS. An additional settlement service would enable NIPS participants to limit the temporal risk created in their role as guarantors of transactions by eliminating overdraft positions at regular intervals. It would also permit participants with accounts at the Federal Reserve to eliminate net debit positions on NIPS with reserve surpluses at the Fed.

Implications for offshore dollar clearing arrangements- To the extent that offshore dollar clearing arrangements are currently settling through CHIPS, an earlier net settlement would allow temporal risk to be reduced by eight to nine hours. If a participating party did encounter a problem it would be frozen out of the market significantly earlier than it would in today's environment. This could potentially decrease systemic risk.

Option 5-- Midnight Fed

A more comprehensive approach involving the Central Bank would have the Federal Reserve extend its current operating hours. For example, after completing daytime bookkeeping the Federal Reserve could reactivate the FedWire and book-entry transfer systems. Following Bankers Trust, we have dubbed this system the Midnight Fed. The rules governing the operation of the nighttime system could be identical to the daytime system including those concerning system net debit caps, the pricing of overdrafts, and the collateralization of excessive overdrafts.⁹

Liquidity- Daily volume at the Midnight Fed would range somewhere between \$30 and \$110 billion depending on the structure of foreign exchange netting agreements. The supply of reserves and collateral available for the nighttime FedWire is large relative to the expected volume. The forty largest U.S. banks held approximately \$14 billion of reserves with the Federal Reserve at year-end 1988. Average daytime FedWire transfers average approximately \$700 billion. Changes in the Federal Reserve's treatment of overdrafts could result in the largest banks posting collateral against overdrafts. At year-end 1988, the forty largest banks reported treasury securities holdings of \$27 billion. However, it is not clear whether this collateral would be available to finance nighttime overdrafts. Therefore, depending on Federal Reserve policy, the nighttime banking system (assuming the forty banks participate) could have liquid balances of between \$14 and \$41 billion. Even using the lower figure, the balance-to-payments ratio is substantially greater than the 1 to 17 ratio found in the daytime market.¹⁰

However, depending on the nature of netting arrangements in the foreign exchange markets, the distribution of transactions in the nighttime market could be much more concentrated. Suppose the dollar side of all currency transactions are netted against each other. Then to help control temporal risk, \$33 billion would have to move among Fed participants in relatively short order. If paying banks and receiving banks are evenly split (a relatively optimistic assumption), then paying banks would have reserves and collateral of \$20 billion against payments of \$32 billion. If uncollateralized overdrafts are prohibited, such a settlement could only be completed if an active fed funds market developed or banks dramatically increased their holdings of Treasury securities.

Implications for the various markets- A Midnight Fed, complete with operation of the bookentry securities system, would solve two of the major problems of NIPS. First, finality would be absolute. Second, funds would be immediately investable in Treasury securities. However, like NIPS, direct access to the system would be limited to banks although it may be other financial participants which are most interested in obtaining access to nighttime payments.

The nighttime operation of FedWire and the book-entry securities system would make possible immediate settlement of spot foreign exchange transactions during nontraditional business hours so long as the foreign currency could also be cleared with finality (i.e., through its central bank or private sector electronic system). Additionally, with both the funds and securities transfer system operating, during crisis periods the Federal Reserve could implement open market operations to insure sufficient liquidity were available.

For the futures market the extended operating hours would provide for the immediate transfer of good funds and/or collateral without exposure to NIPS risk. Thus, most of the payments problems concerning margin calls for this market would be resolved.

The implications for offshore settlement arrangement are obvious. Temporal risk could be eliminated if the Fed supplants the U.S. banks currently providing offshore clearing arrangements, or could simply be used by these banks to enable them to provide final good funds as dollar balances are netted.

Implications for central banks- The choice between NIPS and the Midnight Fed is not clearcut. There are two advantages that NIPS would have relative to the Midnight Fed. First, FedWire encompasses a narrower array of foreign banks, making it less useful for certain types of transactions. Second, with loss-sharing agreements in place, NIPS participants would have fairly strong incentives to control payments system credit risk. This is particularly important since foreign banks are likely to play a disproportionate role in the nighttime markets. NIPS participants may well have an advantage over the Federal Reserve in assessing the credit condition of these banks. However, this latter concern could be mitigated by requiring nighttime overdrafts on FedWire to be collateralized, or by prohibiting them outright.

Other factors tend to favor the nighttime operation of the Federal Reserve. First, banks could economize on transaction costs by utilizing balances

already maintained at the Federal Reserve. Second, permitting government securities transactions to be settled at night on a real-time basis could dramatically enhance the liquidity of the nighttime market by providing banks with an additional method of obtaining reserves.

Implications for monetary policy- It has been argued that nighttime access to reserve accounts would have a significant effect on monetary policy. In fact, some have argued that the Federal Reserve operating hours should not be extended for precisely this reason. In order to address this concern it is necessary to consider the impact that nighttime operations will have on the demand for excess reserves for a given 24-hour interest rate on Fed-funds. The demand for excess reserves is determined by three factors. The first is the profit that could be earned on the additional assets that a bank could buy once it obtained an additional dollar of reserves (i.e., $1/rr$ dollars of assets, where rr is the reserve requirement). The second is the demand for balances held in anticipation of higher future fed funds rates. The third factor is the demand for balances as a precaution against unusually heavy deposit outflow from the nighttime market. If nighttime access to reserve accounts alters the demand for reserves, then the relationship between reserves and the 24-hour rate on Fed-funds will also be affected.

As long as reserve balances are calculated on average over a lengthy maintenance period, the net effect of these three forces is expected to be minor. The introduction of nighttime reserve transfers is unlikely to affect the overall profitability of bank lending and deposit taking. Given the large supply of reserves, the potential for a large amount of collateralized overdrafts resulting from the needs of the daytime market, the potential adoption of multilateral netting of foreign exchange transactions, and the relatively small volume of nighttime transactions, it is unlikely that liquidity considerations will cause the nighttime funds rate to fluctuate enough to significantly increase the demand for excess reserves. As a consequence, neither the one day fed funds rate or the money multiplier are likely to be significantly affected by the introduction of nighttime trading. Hence we believe that the execution of monetary policy will be relatively unaffected.

Options requiring international coordination

The final set of options to be discussed require some degree of coordination either among central banks or among private sector electronic payments systems--e.g., CHIPS and CHAPS. Their main attribute is that they

compensate for the current absence of multilateral netting in the foreign exchange market and the absence of true spot transactions.

Option 6-- Central bank settlement of foreign currency transactions

Under this proposal, central banks would offer payments services in multiple currencies. Commercial banks would be permitted to issue foreign currency demand deposits through branches located outside the currency's home country. Reserve requirements on those demand deposits could be met by posting foreign currency with the host-country central bank (HCCB). For example, a U.S. bank could hold British pounds at the Federal Reserve to meet the reserve requirement for demand deposits denominated in pounds. These foreign currency (pound) reserves could be made available to support a real-time foreign currency electronic payments system operated by the HCCB (the Federal Reserve). If net transfers in the foreign currency exceeded the HCCB's holdings of the foreign currency, excess transfers would have to be submitted to the relevant foreign electronic payments system--CHAPS in our example. Since, in many cases, both sides of a foreign currency transaction could be settled through the same central bank, this option would allow for delivery versus payment in the settlement of foreign currencies much like the Federal Reserve supplies delivery vs. payment for transactions involving book-entry treasury securities.

Liquidity- The liquidity of the payments system could be a serious concern under this proposal. Clearing balances for a particular currency could be spread across a large number of host-country central banks. It is possible that net positions at one host could not be settled at the same time that participants had sufficient clearing balances at other hosts. Thus, participants could face a great deal of unnecessary uncertainty concerning when a payment would be settled.

Implications for various markets- Central bank settlement of foreign currency transactions would make true spot transactions possible. This would simplify the delivery of foreign currency associated with settlement of exchange-traded and over-the-counter foreign currency contracts. This would also make it possible to execute variation margin calls outside of traditional business hours. However, relative to a NIPS facility the lack of liquidity in such a system could make it unattractive for executing margin calls.

Settlement of foreign and domestic currency payment orders within the same central bank would make it possible to provide delivery versus payment when

settling foreign exchange contracts. In the absence of a multilateral foreign currency clearinghouse, there might well be some benefit from such a proposal. However, with the introduction of multilateral netting, delivery risk would be reduced by perhaps 95 percent. This would significantly reduce the demand for delivery vs. payment. In addition, the uncertainty of settlement makes this a relatively unattractive approach for eliminating whatever delivery risk remains.

Use of this option to supplant existing offshore dollar clearing arrangements would significantly reduce temporal risk. For example, the Bank of Japan would hold U.S. dollars and serve a function similar to that currently performed by the U.S. banks (e.g., Chase in the Chase-Tokyo arrangement). Transfers would be in final "good funds" and the temporal risk, common with existing arrangements, would be eliminated. Nevertheless, additional problems would be created.

Implications for central banks- Under this scenario the responsibility and ability to keep a payments system liquid in the face of disorderly market conditions would be unclear. If the host central bank liquefies the system, the foreign central bank loses control of its monetary policy. If the foreign central bank is to maintain the liquidity of these offshore systems, it must monitor a wide array of systems and coordinate carefully with the host-country central bank.

Option 7-- A central switch for central banks

A central bank switch in conjunction with a nighttime dollar payments system--e.g., either Midnight FedWire or NIPS--would be a more effective technique for providing delivery vs. payment for the settlement of foreign exchange contracts. With a nighttime dollar payments system in place, both sides of foreign currency transactions could be settled simultaneously. Each party would enter the transaction into the central switch, at which point it would be matched and verified. At the prespecified delivery time the two payments systems would be queried. If sufficient good funds were available, both sides of the transaction would be executed. Each payments system would be given the freedom to define "good funds." If good funds were not available the query would be repeated, but neither side of the transaction would be initiated.

Impact on the settlement of foreign exchange transactions- While elimination of delivery risk would be possible with such a system, introduction of

multilateral netting would make delivery a relatively unimportant issue. If multilateral netting is introduced, the remaining attraction of this approach is its ability to facilitate true spot market transactions in the foreign currency markets.

Implications for central banks- From a central bank perspective, the use of a central switch to assure delivery vs. payment is clearly preferable to having host central banks settle foreign currency transactions. The system would be more liquid and the responsibilities of participating central banks would be more clearly defined. However, gains relative to NIPS or the Midnight Fed proposal are likely to be minimal. Moreover, the operational cost of such coordination may be relatively high.

IV. The appropriate role of the Federal Reserve in a 24-hour payments system

We have discussed the characteristics of international payment systems, the problems resulting from current payment practices, and alternative private and public sector solutions to those problems. In deciding on the best means to address payment system problems, the role of the central bank is generally assumed to be substantial. Here we discuss the rationale for that role in the nighttime market.

From an operational viewpoint, the entry of the Federal Reserve into the nighttime market to serve the needs of the financial community could be achieved with relatively minor alterations to current operating procedures.¹¹ Accounting procedures would have to be changed, additional staff would have to be hired, choices concerning operating procedures would have to be made, and the implications for monetary policy, if any, would have to be evaluated. However, it would appear that the Federal Reserve could make these adjustments without great difficulty. In question is whether this would be the optimal means to have the nighttime payments system operate. Are there *disadvantages* in having the Federal Reserve have an operational presence in the nighttime transfer system? Would a publicly regulated and supervised payments system operated by the private sector serve to accomplish the same objective as direct central bank involvement? Does the proper role hinge on the Fed's ability to inject liquidity with, and without an operational presence? Are there advantages to having direct Federal Reserve involvement or should every effort be made to resolve the nighttime payments problems with private sector solutions? We address these questions in this section.

Rationale for Federal Reserve payments system involvement

In today's environment it is generally assumed that significant public sector involvement in the payments system is necessary. The Federal Reserve currently has an extensive daytime presence as it provides an array of transfer, collection, and safekeeping services, serves as a bookkeeper and settling agent, has the unique ability to liquefy the system, and sets the rules for payment system practices of U.S. banks. There have been various reasons offered for this extensive Federal Reserve involvement: Congress has mandated it, reductions in inequities and inefficiencies can be achieved, the adverse effects of a highly concentrated correspondent banking market can be alleviated, and excessive risk taking can be curbed. We apply these reasons directly to the nighttime payments system and consider the appropriate role of the central bank.

While it is common to rationalize Central Bank involvement in the payments system by referring to the *Congressional mandate* in the Federal Reserve Act, its reiteration during Congressional hearings in the 1980s, and in the 1980 Monetary Control Act, using this mandate does not adequately address the issue.¹² Congressional mandates can be changed. Payments system involvement by the Federal Reserve in the nighttime markets should be justified on economic grounds.

While *equity arguments* are relevant for determining the proper level of central bank involvement in the payments system, they would appear to be more applicable to paper processing services than to electronic based services. Banks located in rural areas might encounter difficulty in collecting checks drawn on distant banks were it not for the nationwide clearing process provided by the Federal Reserve. Even more important, these banks may encounter difficulty in having their checks accepted at par if the Federal Reserve were not in the market collecting items on all endpoints. However, the electronic services which are under consideration for use during the nighttime hours do not encounter this problem. Remoteness of the initiating or receiving institution is irrelevant. Private transfer networks (CHIPS) are significantly decentralized with participants from around the world and there are no apparent concerns at this time that access to services during these hours would be inequitable.

Central bank involvement in the nighttime market could perhaps be justified on *efficiency grounds*. Although American economic policy has generally

presumed that private entities are at least as efficient as public ones, the Federal Reserve may possess certain cost advantages. Economies of scope may exist in the joint production of nighttime payment services and other Central Bank activities such as reserve balance management, arranging for the holding of collateral, bank examination, account transfers including book-entry transfers, and the extension of intraday and discount window credit. If the Midnight Fed option were chosen, arrangements for discount window loans, accounting procedures, and most operational procedures would already be in place at the central bank. No other entity can take advantage of these economies since none provides all the functions. Similarly, scope economies in the delivery of "nighttime" transfers and "daytime" transfers would appear to exist. Therefore, given that the Federal Reserve already has a market presence, cost economies in extending that presence to the nighttime market most likely exist. Economies of scope between FedWire and the book-entry securities system could prove particularly important in insuring the liquidity of the nighttime market.

However some of these economies will be less important during the night than they are in the daytime system, others may also exist for private transfer networks, and others may be obtainable by private networks relatively soon. Many of the banks that need nighttime payment services will presumably be foreign banks about which the Federal Reserve will know less than it would domestic banks. There will also be a limited number of participants, reducing the costs for institutions of monitoring other participants. Potential scale and scope economies resulting from the production of "daytime" and "nighttime" transfers are also available to existing funds transfer systems. Additionally, under central bank encouragement, private transfer networks are putting in place risk reduction programs in which they will also hold collateral. The net effect of these changes will be to reduce any nighttime payments system cost advantage held by the Federal Reserve.

Fear of excessive market power in electronic payments could also be used to justify Federal Reserve involvement in the nighttime system. While history does not document a preponderance of high clearing charges and poor servicing by established clearing arrangements, there has, over time, been significant concern by Congress about market power and correspondent banking practices.¹³ As a result, it has been argued that a public entity should take an active role to insure market power is not exploited. However, given the current state of relatively inexpensive communications technology, it is doubtful that natural entry barriers lead to a concentration of market power in the provision of electronic payment services. It is also doubtful that market

power would be exploited by a firm in the nighttime market when it would be so much more advantageous to do so in the daytime market because of the volume differential. What is important is that clearing arrangements have objective admission rules to avoid the potential for collusive behavior. To the extent that market power could become a problem, antitrust laws and regulatory oversight would appear to be capable of insuring that abuses do not occur.

Fears that the private sector, left to its own devices, will create an excessive level of risk in the payments system appears to be a more valid justification for central bank presence in the provision of nighttime payments. This occurs as a result of *market failure* because bankers consider only the internal effects of their behavior.¹⁴ For example, in the case of a private funds transfer network, a bank receiving provisional funds will evaluate the risk on its operations in deciding whether or not to allow the funds to be used by its customer (i.e., to extend credit). If the sending institution is unable to settle by the end of the day it will adversely affect the bank which allowed its customer to utilize the funds. However, the risk of that occurring was accounted for. If that event in turn caused that bank to be unable to meet its payment obligations to other banks in the network then additional cost spillovers would occur. These costs, imposed on banks further down the payments chain, did not enter the decision process to extend the credit and were not accounted for by the parties generating the risk. This is a classic case of a negative market externality.

To eliminate problems resulting from such externalities the participating banks can agree to loss-sharing arrangements and credit limits to enable them to offer finality to their customers. Alternatively, they can use transfer systems with "deep-pockets", such as FedWire, which guarantee finality. Either solution places banks in a situation in which they are assured of being able to settle. With FedWire finality they do not need to be concerned with the credit worthiness of other payment system participants with which they interact either directly or indirectly. Thus, there is no reason for banks to expend resources for this purpose. The risk resulting when either a loss-sharing arrangement or external guarantee is not in place has been the main reason payments system participants have asked the Federal Reserve to become involved in the nighttime market, and is a major reason for the Risk Reduction Program recently introduced by the Federal Reserve (Board of Governors, 1989).

There is significant disagreement on the extent of the problem resulting from these externalities and about the ability of private markets to account for them. However, there is little doubt that regulators respond as if the potential for significant spillover effects exists.¹⁵ There is reason to believe that the extent of the payment system externalities might be somewhat less in the nighttime market as a result of better information concerning the relatively few domestic institutions participating at this time. However the participation of a larger number of foreign banks, for which information may not be as thorough, could lead to greater externalities.

Alternative levels of Federal Reserve involvement

If public sector intervention is warranted in the provision of a nighttime payment system then the form it takes can vary significantly. We consider four (non-mutually exclusive) alternative forms of market intervention for the Federal Reserve: to supervise and regulate the market, to provide settlement services to accommodate private clearing arrangements, to have an active operational role, and to provide liquidity to the market.

It would appear that *intervention via supervision and regulation* would be far reaching enough and could be utilized to resolve most of the potential payment system problems discussed earlier. Externalities could be addressed by imposing guidelines on clearing arrangements. In its Risk Reduction Program the Federal Reserve has significant influence over the operational characteristics of private network clearing arrangements which ultimately settle through it. This allows it to persuade private networks to introduce risk sharing agreements and finality arrangements which should minimize or eliminate externality problems.¹⁶ This has been the approach taken in the daytime markets.

A second level of involvement in the nighttime market would have the Federal Reserve with a *minor operational role* in addition to its regulatory function. This operational extension would consist of additional net settlement services offered during the early morning hours (perhaps 8:00 or 9:00 a.m. EST). As discussed in the previous section, this would allow clearing arrangements to eliminate temporal risk by settling morning positions with final good funds over FedWire. The cost to offer such a service would be minimal. From the banks' perspective there are tradeoffs from having an additional settlement period. First, risk is reduced as the number of settlements increases. However, there are operational costs involved in

positioning the bank to meet the settlement requirements which increase with the number of settlements. The optimal number of settlements minimizes the combined total cost, i.e., risk plus operational expenses. The optimal number of settlements may indeed be greater than the single one currently performed at the close of FedWire.

Alternatively the Federal Reserve could intervene in the payments system by having a *significant operational presence*. This has been a method employed in the past to help guide the markets in a desirable direction. The alternative forms this presence could take were discussed in the previous section. While direct government intervention in the operation of private industry is not common in the U.S., this approach has occasionally been used.¹⁷

Given that the Central Bank already operates in the payments system, it would appear to be relatively easy to rationalize an extension into the nighttime market. As mentioned earlier, all the basic arrangements and infrastructure would already be in place and it is doubtful that the cost would be prohibitive. However, justification for an operational presence relies heavily on costs advantages. As discussed above, many of the Central Banks' cost advantages may be evaporating. Additionally, from a pure cost efficiency standpoint, most studies have found private production to be superior to that of public firms.¹⁸ Even if the payments system had natural monopoly characteristics, which most likely is not the case, one could not easily justify the monopoly being a public entity. Concerns about market externalities may justify a central bank presence, however, there is every reason to believe that these could be controlled with supervisory/regulatory powers. Again, the best justification for a Federal Reserve operational presence in the payments system is based on operational advantages resulting from scope economies. That is, nighttime operations by the Federal Reserve may be cost effective simply because it is already in the daytime market.

A fourth level of involvement in the nighttime payments system for the Federal Reserve is to have it *stand ready and able to liquefy* the markets. This is a well established responsibility for the Federal Reserve since it alone has the ability to generate high-powered money. While the figures discussed earlier suggest that liquidity will probably not be a significant problem in a nighttime market (and would probably be a nonissue with the NIPS option), the Federal Reserve needs to plan for the exceptional periods. Liquidity concerns could become significant over time, or, most importantly, during periods of temporary instability--e.g., during the October 1987 period. Therefore the Federal Reserve should somehow be able to liquefy the

nighttime market to prevent payments system gridlock and to calm the markets should an infrequent crisis occur.

Although it is generally accepted that the central bank should serve this role, the means by which it can best be achieved in the nighttime market is not obvious. At issue is whether or not it is easier to liquefy the market if an operational presence exists. Liquefaction typically occurs through open market operations, discount window loans, or loans from overdrafts allowed by the Federal Reserve. However most discussions about Central Bank involvement at night have not envisioned it conducting open market transactions or opening the discount window. Some discussions have assumed FedWire alone will be opened leaving the securities transfer service closed. This leaves overdraft-produced loans as the Federal Reserve's sole means of "injecting" liquidity (and then only to the extent desired by market participants). This would imply that an operational presence would be required for injecting liquidity. However, it is doubtful that anyone would want to justify the Fed's operational presence this way and, quite frankly, it is totally unreasonable to believe the Federal Reserve will use only this means of liquefaction during crises. A more reasonable solution would have it open the discount window or have "stand by" ability to participate in the markets through a private transfer network in which it could initiate securities transfers or collateralized loans. Neither of these methods would require FedWire to be opened.

Problems resulting from Federal Reserve involvement in payments

Although Federal Reserve involvement in the payments system can address payment system problems, this intervention is not without costs. The regulation/supervisory function itself is costly and direct market intervention generally produces distortions in market behavior which may impose significant costs on society. For example, the provision of finality of payment on FedWire may increase certainty in the payments system as it eliminates risk concerns; but for the same reason may increase the total risk level in the system as it distorts the behavior of participating banks which realize the risk is shifted to others. Access to a lender of last resort may serve as a secure source of liquidity; but it also discourages institutions from developing private credit arrangements which may be needed during crises. The willingness of the Federal Reserve to guarantee limitless intraday credit extensions enabled banks to carry out transactions without concern about synchronization of

inflows and outflows of funds; but it also created an environment in which excessive risk was concentrated at the Federal Reserve.

Although the costs resulting from these policy-induced adverse practices are difficult to quantify, they are by no means minor. Any actual or perceived guarantee will distort behavior toward accepting more risk than would otherwise have occurred. The failure of the private sector to independently develop clearinghouse loss-sharing agreements and detailed arrangements for priority claims in today's markets no doubt partially results from a notion that such arrangements are unnecessary given the presence of the Federal Reserve as a backstop during crises. Thus, the adverse effects of central bank presence in the payments system should also be considered in deciding on its proper role in the nighttime market.

Federal Reserve Role: Summary

Intervention by the central bank in the nighttime payments system is warranted when externalities or other forms of market failure occur, or when superior production efficiency exists. It is generally accepted that certain externalities exist suggesting that the Federal Reserve has a role. In deciding what form that role should take there is significant disagreement in the industry. The role of market liquefier is accepted by almost everyone and appears to be a logical responsibility of the Federal Reserve for the daytime or nighttime market. However, the vast majority of the time, liquidity will not be an issue if nighttime payments are left to the private market. Most remaining concerns about problems resulting from the private market provision of payment services would appear to be resolvable through supervision and regulation.

Although there would probably be minimal costs involved in extending current Federal Reserve operations to service nighttime customers, one needs to consider the potential distortions its presence could cause in the market. Ideally, the distortions would be eliminated before the decision to extend service hours is made.

V. Summary and policy recommendations

During much of the 24-hour day, financial market participants find it difficult or impossible to eliminate emerging market risk by transferring cash or collateral. In most cases participants do not have the option of eliminating

this risk by settling transactions on a delivery vs. payment basis. Additionally, unlike domestic transactions, it is difficult for participants to limit the delivery risks inherent in international transactions by having settlement occur relatively soon after the initiation of payment. Ten years ago these problems were not important. However, the financial markets have changed significantly over this period. The hours during which markets are active have been extended for some financial products and will be extended for others in the immediate future. Financial transaction activity has grown exponentially. These changes have occurred without corresponding changes in the payments systems.

This study reviews trends in the flow of international payments, characteristics of existing payment system arrangements, problems inherent in these arrangements, and alternative means to remedy the problems. Recent changes in payment system practices, such as the movement toward netting arrangements and implementation of loss-sharing agreements allowing for settlement finality, are beneficial in that they will lead to significant cost reductions and decreases in payments system risk.

However, given the changing financial markets and the growing demand for transfers of value during nontraditional business hours, the changes to date may be inadequate. We find potentially significant demand for nighttime payments arising from the market for U.S. government securities, cross-border securities lending, offshore dollar clearing systems, settlement of foreign exchange activity, and margin calls for exchange-traded derivative products. Excluding offshore dollar clearing arrangements, we estimate the potential demand for nighttime transactions currently to be between \$30 and \$110 billion a day; or 2-6% of current daytime volume.

In addressing these issues from a policy perspective, the major objectives would appear to be to improve payments efficiency and decrease settlement risk by providing the ability to conduct transactions at night.¹⁹ We identify and analyze seven options to achieve these objectives:

- 1) Intrabank transfers
- 2) A Nighttime Private Interbank Payment System (NIPS)
- 3) 24-Hour Mutual Fund
- 4) Additional Central Bank Net Settlement Services
- 5) A Midnight Fed (i.e., 24-hour FedWire)
- 6) The Central Bank Settlement of Foreign Currency
- 7) A Central Switch For Central Banks

The implications for various segments of the financial marketplace are summarized in Table 8

In our opinion the viability of the first option as a solution to nighttime payment problems can be rejected because a large portion of the demand for transfers during these hours involves moving funds between banks. For our purposes, the two options requiring international cooperation between central banks (6 and 7) are also rejected. The rejection is not based on the merits of the two options, but rather the belief that they are simply not viable alternatives for the foreseeable future. Their implementation would require too many events to occur which are outside the control of the U.S. central bank. The "space age" characteristics of these options make their imminent adoption unlikely, and the introduction of foreign exchange clearinghouses would significantly dampen the need for the services. In general, we believe that many of the benefits offered by these two options can be achieved with other alternatives without the accompanying problems.

The remaining options can be divided into two categories: private sector solutions with public sector oversight, and public sector provision of transfer services during nontraditional hours. In our opinion the bulk of the solutions to current payment system problems should come from the private sector. Similarly, the bulk of the risks resulting from payment system activity should be borne by financial institutions and their customers. However for these solutions to be efficiently and effectively implemented the private sector needs the tools to adequately manage payment system risk. The central bank has the ability to provide those tools without distorting the marketplace. Therefore, a combination of the remaining options would appear to be most appropriate.

As a first step, to decrease settlement risk for the derivative product markets and to create an environment conducive to the development of a safe and efficient private nighttime transfer system (NIPS) *we recommend* that the Fed open the book-entry and funds transfer services earlier and²⁰ offer an additional net settlement service to decrease temporal risk on NIPS. While the provision of finality on these private networks will decrease the need for Fed finality, offering the additional settlement should decrease the monitoring cost required of banks for controlling temporal risk which would otherwise exist until the close of FedWire. Use of the early settlement service would be required for institutions wishing to use other Fed services.

We believe the role of the Central bank, however, should be to supplement the private sector. Therefore *we also recommend* that the Federal Reserve issue a policy statement which very strongly advocates the use of netting with novation and substitution, and meaningful loss-sharing agreements (perhaps collateralization). These should improve efficiency and significantly improve finality on private arrangements. The development of these agreements would also be a requirement for parties desiring to use any of the Fed's payment system services. If arranged at the network level, the limited number of participants would make the monitoring process manageable and the resulting benefits from efficiency gains and risk reduction should be substantial. Finally, without formally sponsoring any specific program, the Federal Reserve should not be adverse to the development of multicurrency arrangements similar to the 24-hour mutual fund option. However, the Fed should emphasize that these arrangements should also have certain risk controlling characteristics similar to those already imposed on payment systems wishing to settle through the Federal Reserve. A 24-hour mutual fund could be beneficial to the market because non-banks would have direct access to them and certain financial market participants may find these types of clearing arrangements to be more conducive to their particular needs, e.g., derivative market participants.

We know that many market participants will favor the extension of existing daytime Fed services to cover the full 24 hour day. However there are numerous problems with this approach. First, most studies generally find that productive efficiency is enhanced with the private sector provision of services relative to that of the public sector. Second, should the Fed simply expand current operations to the nighttime there would probably be significantly less incentive for the private sector to make needed changes in their operations. Third, and perhaps most importantly, we know that the Fed's presence in the provision of payments, as currently structured, distorts market behavior and causes excessive risk taking.

However, having a modified version of FedWire and bookentry services operative in conjunction with private firms during the nighttime hours may still be socially optimal given that it already operates during the daytime. That is, if the Fed is to participate in the provision of payment services it should do so by the most efficient means possible. As a result of the fixed costs already incurred by the Federal Reserve by operating during the daytime, the scope and scale economies realized if transfer volume increases when hours are extended may result in lower average costs. At issue, obviously, and a topic beyond the scope of this paper, is whether or not the

Fed should even have an operational presence in the daytime market.²¹ However, if the Fed continues to have a daytime presence, it seems only logical that it also serve a constructive role in the nighttime market. *We therefore recommend* that the Federal Reserve modify its services offerings (as discussed below) and open sufficiently early to make them available while the Japanese markets are open.

The extension of hours, however, should not occur without first implementing modifications to eliminate the distortions induced by the current operational practices. These would include the full collateralization of overdrafts and the elimination of the below market interest rates currently charged for emergency loans at the discount window. Strong consideration should be given to making these changes even if the Fed continues to operate only in the daytime market. With the elimination of these distortions, any superiority of Fed-provided services relative to private sector service would be the result solely of cost advantages and not of subsidies. While the Fed's ultimate role under this scenario will be determined by the marketplace, we believe it will be significantly limited. Intraday credit decisions will be made predominately on private sector networks and the Fed (with its finality) would periodically be assessed to cleanse risk from the private system. We believe this is its proper role.

There are additional changes other than those from the list of options discussed above which could influence payments risk. The basic causes of the astronomical rise in payments by U.S. banks relative to the reserve base which supports them is frequently ignored. The increase partially results from the significant economizing on reserve balances as a result of the existing regulatory and legislated rules which prohibit the paying of interest on demand deposits and bank reserves. This economizing obviously creates tendencies for overdrafts, and as a result, credit risk. Elimination of these rules could result in a larger reserve base and reduced payments system risk. However, our priors are that in spite of the potential benefits from these changes, and similar recommendations by high ranking Federal Reserve Officials (Corrigan, 1987; and Lindsey, et al., 1988-Appendix B), it is doubtful that they will be adopted anytime soon. The paying of interest on reserves would significantly reduce the revenues the Federal Reserve turns over to the Treasury each year; thus, adding potential pressure to the budget deficit. The paying of interest on demand deposits would not entail the same expense, but Congress has been steadfast in refusing to consider this issue in recent years.

One final point should be mentioned. In researching this topic a number of interviews were conducted with representatives from commercial banks, investment banks, and other institutions which rely heavily on a reliable, efficient payments system. A concern expressed by some was whether, given recent market trends, the dollar would continue to be the major world currency and the U.S. financial system a premier component of the global financial system. The issue arises because of concerns about regulatory restrictions on payments activity of U.S. based institutions, and preferred treatment of financial institutions by central banks abroad. Our feeling is that our recommendations discussed above best respond to these concerns. It is important that financial activity not be unnecessarily restrained by antiquated payments systems. Private sector solutions should be encouraged and the central bank should enable temporal risk to be eliminated on a timely basis by allowing institutions to settle in final funds more than once per day. In our opinion, it is not important, and is actually disruptive and inefficient, for the central bank to subsidize the U.S. payments systems to "meet" the compatibility of central banks in other countries to their financial institutions. Solutions to payments system problems would appear to be best handled in the private marketplace with the central bank providing the private sector with the ability to control risks and costs.²²

Footnotes

¹The reader is referred to Pavel (1990) for a more complete discussion of recent trends in international financial activity.

²A report by the group of 30 recommends, among other things, that settlement of securities transactions occur three days after the trade is initiated. The current U.S. standard is five days. The report also seeks creation of delivery vs. payment settlement systems where feasible and encourages securities lending as a means of expediting settlement.

³The underlying instrument is worth \$1 million.

⁴For a discussion of the various settlement systems in the derivative product markets see Rutz (1988).

⁵What information does exist is generally based on confidential material obtained for individual arrangements. Since our estimates cover a relatively broad range it is doubted that the exclusion of this sector appreciably effects our projections.

⁶This arrangement has been proposed for institutions overdrafting their Federal Reserve account as a direct result of book-entry induced overdrafts.

⁷For specifics of the Bankers Trust proposal see the prospectus for the Global Settlement Fund, Inc. (Bankers Trust, 1989a). It should be noted that the Fund, as originally structured, credited daily interest based on a shareholder's minimum daily balance.

⁸Data are based on December 1988 Report of Condition. Treasury holding are not broken down by maturity, therefore, estimates were developed by assuming that the ratio of Treasury securities to all securities was constant across maturities.

⁹Various permutations from the daytime FedWire operations are possible. For example, one could allow or disallow overdrafts, price them the same or differently from daylight overdrafts, allow only collateralized overdrafts during the night, leave the book-entry transfer service closed during the nighttime market, etc.

¹⁰In 1988 the daytime ratio for all banks was approximately .06 (Humphrey, 1989). For a select group of Seventh Federal Reserve district potential users of Midnight Fed the ratio was .02.

¹¹For example see McPartland and Taylor (1989) or Bankers Trust (1987).

¹²See paragraph 14, section 16 of the Federal Reserve Act (1988), U.S. Congress (1984), and Monetary Control Act (1980). For a summary of this support see Evanoff (1985).

¹³For example see White (1983); particularly chapter 2.

¹⁴Humphrey and Berger (1989) discuss the failure of markets (externalities) in paper check services. In the worst case electronic transfer system crisis scenario, the actions of one bank would lead to the failure of others unless an adequate liquidity source were available to liquidate assets at "typical" market prices--i.e., non-firesale prices. It is these negative externalities or spillovers which are most feared by regulators. However, it is possible that a collection of clearing banks, e.g., a clearinghouse group, could set up procedures to significantly decrease this risk.

¹⁵Discussions of the private markets ability to endure market shocks can be found in White (1983), Calomiris (1989, 1990), Kaufman (1988), and U.S. Congress (1913). A recent study evaluating potential systemic concerns in payments can be found in Humphrey (1986). In this study actual CHIPS transaction data were used to simulate the ramifications of the failure to settle of a large CHIPS member. However, liquidity alternatives were precluded in the analysis, thus

the study serves to demonstrate the operational and liquidity problems with the CHIPS unwinding procedures instead of directly addressing the systemic risk issue.

¹⁶The recent proposal by CHIPS to move to a form of finality was the result of Federal Reserve moral suasion. The Risk Reduction Program proposed in 1989 has an explicit policy statement suggesting offshore clearing arrangements having similar characteristics. Why is this suasion necessary? Some argue it is because large banks feel they have an implicit guarantee from the central bank in the event of excessively volatile markets. Thus, they have less of an incentive to protect themselves against this eventuality. This is also a reason given for the relatively slow movement toward explicit loss sharing and multilateral netting arrangements on the private payment networks.

¹⁷For example, the French government took an operational presence in the automobile industry to encourage it to begin manufacturing less expensive cars. This relatively successful endeavor (Sheahan, 1960) enabled the low income sector to have access to affordable automobiles. However, similar success stories concerning government operational intervention are not common.

¹⁸For a review of the literature see Borchering, et al. (1982).

¹⁹While striving for efficiency improvements in the payments system is considered a policy objective, it does not appear to be the driving force in recent policy debates. It is doubtful whether the current debates would be underway if the only thing to be achieved were cost reductions in existing payment system arrangements. Similarly, if reductions in risk could be arranged without any cost savings, regulators would most likely be satisfied. However, given the nature of payment systems, efficiency gains may be a beneficial by-product of options aimed at reducing risk.

²⁰Recent changes in Federal Reserve operations suggests that the earlier opening may soon be a reality. In 1990 the hours of FedWire across offices were standardized resulting in the earlier opening of some offices. Serious discussions concerning the opening of FedWire at 6:30 a.m. EST in 1991 have also taken place.

²¹This issue should not be taken lightly. While a role for the public sector may indeed be warranted for the reasons given in the previous section, using an unusual approach such as an operational presence to fulfill that role should be thoroughly critiqued. In particular, one should evaluate the advantages/disadvantages of using this approach instead of regulatory oversight.

²²It should be reemphasized that we are *not* recommending the subsidization of the U.S. payment system. The intent is to prevent existing payment system arrangements from being a clog in the process of using the dollar and having U.S. financial institutions involved in international transactions by making relatively minor, cost-justified modifications to these arrangements.

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Appendix I

Background: costs and risks of international transactions

The increase in the number and dollar volume of international financial transactions is giving financial market and payment system participants the incentive to reduce both the costs and risks involved in these transactions. To understand the deficiencies in the existing payment systems, as well as the implications of proposed changes, it is necessary to have an understanding of the nature of the costs and risks involved. We briefly discuss these aspects of payment and clearing arrangements and in the process develop terminology to be used throughout the article.

The potential costs of executing a financial market transaction--be it a foreign exchange contract, a securities trade, a futures contract, or an option contract--include *transaction costs*, *foregone earnings* on balances associated with the transaction (e.g., margin or collateral), and any *credit evaluation costs* incurred before agreeing to enter the transaction.

The major risks involved with financial transactions are liquidity, credit, and systemic risk. *Liquidity risk* results from the potential that payments will not be made when due, but will be forthcoming at a later date. *Credit risk* results from the possibility that full payment may not be possible at any date.

Credit risk can be further delineated into two components. If a counterparty defaults on the obligation before it is due, the contract may only be replaceable at a higher cost. This is *market risk*. It is a function not of the gross value of the contract, but of the difference between the original cost of the defaulted contract and the current cost of obtaining the same contract. Parties to transactions are also subject to *delivery risk*. That is, the risk that one party will fulfill his settlement obligations under the contract while the counterparty does not. Unlike market risk, delivery risk applies to the gross value of the obligation.

Credit risks may be direct or indirect in nature. *Direct credit risk* results from the possible default of counterparties with which a bank conducts business. *Indirect credit risk* is the risk that participants in a settlement system will not meet their obligation(s) solely because other participants have failed to meet theirs. This risk arises when parties transact with a wide array of counterparties who, in turn, have a large number of transactions with each

other. In this situation it is difficult for any one party to make more than a crude determination of his exposure to a given counterparty, since the failure of one counterparty may result in significant difficulties for others. Indirect credit risk is an important feature of both the interbank foreign exchange market and the interbank electronic payments system.

Systemic risk occurs when a large number of parties find it so difficult to value the direct and indirect credit risks associated with the clearing and settlement of transactions that they simply abandon the market. In the market for bank deposits this is manifested in a run from deposits into currency. In a financial market it is manifested in a cessation of trading through conventional channels. Although regulators are concerned with risk in general, systemic risk is feared most.

The extent to which the risks discussed above are associated with payments activity depends directly on payment practices. In the remainder of this section we discuss certain aspects of payment practices which affect participant risk, and evaluate changes which could produce reductions in this risk.

Lags between contract initiation and settlement

The level of credit risk in a financial transaction is partly a function of the lag between initiation and settlement of the transaction. Lags can arise from the nature and function of the contract--as with futures, forwards, swaps, and options--or from institutional practices--as with securities settlement and some interbank electronics payments systems like CHIPS and CHAPS. In some cases lags are the result of time zone differences of the counterparties; for example, local business days in Japan and the U.S. do not overlap, making it difficult for firms to initiate payments which can be settled quickly. In other cases lags arise because of the difficulty of moving a physical security or commodity between parties to a transaction. This can be the case with securities that are not traded on a bookentry basis.

Whatever the reason for the lag between transaction initiation and settlement, longer lags increase market risk since the probability that market prices will drift away from the contract price increases with time. The greater this drift, the greater the cost of replacing the contract should default occur. Therefore, as lags increase, the cost of replacing a defaulted contract and the probability of default both increase resulting in increased total risk.

Delivery versus payment

Institutional deficiencies can also complicate final settlement of contracts. For example, with a foreign exchange contract, one side of the transaction may be completed in a market in one time zone, with the other side being completed in another market and time zone several hours later. Delivery risk occurs because payment from one party is executed prior to the other. As a result, liquidity and credit risks are assumed. More generally, without simultaneous processing, liquidity and credit risk increase whenever a counterparty delays delivery.

Delivery versus payment structures eliminate delivery risk by making possible the simultaneous exchange of a financial asset and the corresponding payment. There are particular types of transactions for which use of delivery vs. payment could significantly decrease risk. We discuss some of these in Appendix II.

Gross versus net settlement

In certain markets each contract is settled separately even though there may be other offsetting contracts to be settled on the same date. This practice is known as trade-for-trade or *gross settlement*. It results in a relatively large volume of transactions which affects the costs of trading by raising the number of transactions, the resulting accounting costs, and credit risk.

Under a *net settlement* structure, the contracted debits and credits for each transacting party are summarized over a specified time frame. Net settlement reduces transactions costs by collapsing the multiple transactions inherent in a gross system into a single transaction. It has been estimated that in certain markets netting arrangements could decrease transaction volume by 95 percent. However, reductions in transaction costs need not imply reductions in risk. Risk control depends on the arrangements made by the clearinghouse to insure settlement is possible. Some of these arrangements are discussed below.

Position versus novation netting structures

The amount of credit risk borne by each party in a transaction is determined in part by his legal obligation in the event of a counterparty default. Under *position netting*, each party settles for the net amount in the absence of default; however, underlying liability for the gross amount of each contract is

retained. The CHIPS network is an example of a position netting system. *Netting by novation* performs the same transaction summary as position netting. However, each time a trade is made with this structure a new or "novated" contract is created for the revised net amount and all previous contracts are discharged. Thus, participants are contractually obligated to a running net debit or credit position.

Both position and novation netting reduce transaction costs and liquidity risks. Liquidity risk, and hence the need for intraday liquidity, are reduced to the extent that unexpected changes in debits are offset by unexpected changes in credit of a similar magnitude. However, netting by novation provides additional reductions in credit and systemic risk. Under novation the transacting parties are no longer liable for the gross amount of each individual contract, but only the netted amount of the novated contract. This reduces both market and delivery risk. However, the risk reduction of netting by novation is dependent on the legal enforceability of the novated contracts superseding the underlying gross contracts. No case law exists on netting by novation for various types of financial transactions.

Bilateral and multilateral netting structures

In a *bilateral netting* structure every transacting party in a clearing arrangement clears and settles with each counterparty with whom a contract has been negotiated. A *multilateral netting* structure nets a participant's position with all the other participants as a group. Thus, a net position to the system will be paid/received. The multilateral structure results in lower transaction costs because of the reduced number of transactions required. This reduction is significant when the number of participants is large and there are relatively few transactions between any two participants.

Whether or not the multilateral structure achieves a lower level of risk than the bilateral structure depends on the policy of the clearing and settling entity. It may simply engage in position netting for all participants, making no guarantee of performance. In this case there would be no reduction in risk relative to the bilateral structure. Alternatively, the clearing entity may pursue a policy of substitution.

Substitution occurs when the clearing entity is "substituted" as the counterparty to all trading parties. Participants in a structure with netting by novation and substitution trade with indistinguishable homogeneous

counterparties and initiate (receive) a single payment per currency per settlement date to (from) the third party.

This structure has the potential to greatly reduce both costs and risks relative to the netting forms discussed above. The key to the additional benefits is that one entity is acting as a counterparty to all transactions. However, the substitute receives its strength and viability from the individual market participants, thus, it frequently imposes strict rules and capital requirements on them. The relative success of this form of netting in reducing risk is tied entirely to the financial viability of the third party, e.g., the capitalization of the entity serving as the substitute.

Other risk management structures

Clearing and settlement systems employ other standard techniques to control clearinghouse and participant risk. Most systems review the financial status of new participants and periodically review the soundness of all participants. It is also becoming increasingly common for payment or clearing systems to limit participant exposure to one another. This can be achieved with *bilateral credit caps* which limit the credit exposure a participant is willing to accept from other individual participants in the system. *System net debit caps* and *system position caps* limit the exposure of a participant from all participants in aggregate.

In cases where there is a long lag between contract initiation and settlement, intermediate settlement in the form of variation margin payments may be used to control market risk. The use of variation margin plays a significant role in the futures markets.

Credit exposure can also be limited by requiring participants to maintain collateral with the clearing and settling entity. This collateral may be posted by the party creating the credit risk (e.g., initial margin on futures contracts or proposed collateralized overdrafts on FedWire), or may be posted in fulfillment of the participant's obligations under a loss-sharing agreement (e.g., as proposed for CHIPS). Collateral strengthens the systems' ability to respond to crisis situations and, in the case of a loss-sharing agreement, decreases the potential for crises as it encourages participants to monitor the risk level of other members.

Appendix II

Background: present clearing and settlement systems

A number of clearing and settlement systems have developed over time to initiate and complete payment for international transactions. A comparison of these systems serves to highlight their distinguishing features. Systems discussed include those for executing currency payments: FedWire, CHIPS, CHAPS, FXNET, BOJ-NET, and offshore dollar clearing arrangements; and various securities clearing systems.

Currency Payments

FedWire

FedWire is operated by the Federal Reserve System and is currently limited to U.S. dollar-denominated transactions initiated and received by institutions in the U.S. It is a real-time bilateral gross settlement system with substitution. Since FedWire transfers are guaranteed by the Central Bank, and overdraft positions are allowed, liquidity and credit risks are minimized for participants. Thus, the receiver risk inherent in

other systems can be ignored. However, the risk itself is not eliminated; rather it is transferred to the central bank. In the case of daylight overdrafts the Federal Reserve System incurs the risks and is essentially financing intraday loans. The Fed realized this shifting of risk had occurred and in 1986 implemented bilateral and cross-system caps to control risks. Implementation of pricing and collateralization of daylight overdrafts are also being considered (BOG, 1989).

The Federal Reserve also operates a bookentry securities system. Upon request, this system provides delivery vs. payment for transactions involving U.S. government securities. However, once again payment may result in the overdrafting of the debited institutions account. Alternative means to address these intraday loans are also being considered by the Federal Reserve.

CHIPS (Clearing House Interbank Payment System)

CHIPS is a private payments clearing system located in New York and operated by the New York Clearinghouse Association (NYCHA). It is a

dollar-denominated network specializing in international payments. An estimated 90 percent of all international interbank dollar denominated transactions are transferred through CHIPS--of which a large portion are foreign exchange transactions. Current CHIPS activity is summarized in Table A-1. However, in response to numerous factors, including the Board of Governors 1989 Payments System Risk Reduction Proposal (BOG, 1989), the characteristics of CHIPS volume could change significantly in the future. It is expected that CHIPS will begin to compete more directly with FedWire for domestic commercial transaction activity. Payment orders submitted to CHIPS undergo multilateral position netting and final settlement of the net positions occurs at the end of the day through FedWire. Receiver risk is controlled through the use of bilateral credit limits, while indirect risk is reduced through multilateral net debit limits. Cross system caps involving FedWire and CHIPS are used to reduce overall U.S. payments system risk. Since the CHIPS network does not allow for delivery versus payment, its use to settle the dollar side of foreign exchange and securities transactions leads to the creation of delivery risk.

The multilateral structure of the CHIPS network permits participants to pay or receive one net amount daily as a result of the clearinghouse standing in as the representative (but not guarantor) for all counterparties. As discussed earlier, this significantly reduces transaction costs. Since CHIPS is currently a position netting system, it simply nets debits and credits without discharging the underlying individual liabilities. The credit risk inherent in such an arrangement could be reduced by moving from a position netting arrangement to netting by novation (i.e., one in which a new contract is created with each transaction in the amount of the summarized debits and credits).

Payments received through CHIPS are good but imperfect substitutes for payments received through FedWire. Once a message is transmitted over CHIPS it is considered irrevocable. However, if the sender fails prior to settlement the receiving bank would have an unsecured claim of uncertain maturity. Consequently, there is no guarantee that the parties will receive funds at the end of the day. In case of a participant default on CHIPS the system would implement Operating Rule 13--initiation of a deletion and unwinding process. The legal and practical status of deleting the transactions of a defaulting party and subsequently recalculating the position of participants who transacted with the defaulting party is open to debate. To date the rule has never been applied. Proposed operational changes to CHIPS would significantly alter this procedure.

In April 1989 CHIPS members approved several operational changes which will provide receiving institutions with significant protection against defaults by sending parties (Lee, 1989). The changes are scheduled for implementation in 1990. They will give receivers the status of a partially secured creditor, and attempt to insure that sufficient collateral is available to guarantee final settlement. Under the proposal, payments would be subject to multilateral netting by novation. In addition, any losses arising from the failure of a single CHIPS participant would be distributed across the remaining participants. Under the new system, participants would continue to set bilateral net debit caps for counterparties, and their share of losses arising from the failure of a counterparty would depend on the prearranged caps. Total losses by members through the loss-sharing agreement would be capped at an amount sufficient to cover the loss arising from the failure of the largest single participant. The risk reduction proposal clearly represents a significant reduction in payments system risk.

CHAPS (Clearinghouse Automated Payment System)

CHAPS is a large value electronic credit transfer system providing same-day value for sterling payments. Located in London, the clearing network is structured similar to its dollar counterpart--CHIPS. There are 14 CHAPS members or settlement banks which operate the system and settle at the end of the day through the Bank of England. Transfer services are made available to other banks and customers through the settlement banks.

The CHAPS network was introduced in February 1984 to improve upon the paper-based Town Clearing system through which large value payments drawn on or paid into London-based bank branches were executed. The minimum acceptable CHAPS transfer has been lowered over time, and the Town Clearing minimum raised, to encourage use of the new electronic system. Historical volumes are summarized in Table A-2. Transfers through CHAPS are generally considered "final" in that they are guaranteed, irrevocable, and unconditional. However, the system is a private arrangement and transfers are guaranteed by the full faith and value of the *sending member*, and not the Bank of England. The Bank of England serves a dual role in CHAPS as both a settlement or member bank, and as a central bank which settles end of day positions for all settlement banks. However, it does not have explicit responsibility for the operation, efficiency, or integrity of the system. For further detail see Allsopp (1989) or Geva (1988). Additionally, the receiving bank is not required to provide customers with immediate access to funds. However, as with CHIPS payments, the provision of immediate

access is common. The current structure of the system does not allow members to refuse payments from other member banks. Thus, controls similar to those recently implemented on CHIPS are not viable at this time and receiving banks do incur significant intraday exposures.

BOJ-NET

As the Japanese banks have become increasingly more important in international financial flows, the efficacy of their transfer systems have accordingly become more important. The Bank of Japan Financial Network System, or BOJ-NET, is the Bank of Japan's cash and security-wire transfer system. Like FedWire, BOJ-NET limits transactions to the national currency—the Japanese yen. The cash-wire system is an on-line funds transfer system for account holding institutions and is the on-line processing system for the Japanese counterpart to CHIPS, i.e., the Gaitame Yen Settlement System. The security-wire system handles the fiduciary responsibilities for the Japanese government by registering bonds, operating a bookentry system, and auctioning new government bond issues. This system is currently being updated to decrease processing time.

Financial institutions use BOJ-NET to provide net settlement services in next-day funds for the clearinghouse system which multilaterally clears bills and checks. It also provides net settlement in next day funds for the increasingly popular Zengin System, a domestic interbank EFT system used by more than 5,300 institutions. Despite the next-day funds provision of the Zengin system, the receiving banks typically provide same-day credit to their customers, due to the Bank of Japan's guarantee of settlement. The Bank of Japan does not bear sender risk, though, as it requires participating banks to deposit collateral.

Finally, BOJ-NET provides net settlement in same day funds for the Gaitame Yen Settlement System, which settles yen payments arising from cross-border transfers and foreign exchange transactions. Like CHIPS, the Gaitame Yen Settlement System imposes bilateral net credit limits and has implemented a loss-sharing rule to decrease system risk concerns. BOJ-NET processing of Gaitame transactions summarizes the day's transactions in order to settle the net positions to BOJ accounts. Settlement policy at the Bank of Japan differs from the Federal Reserve System. Daylight overdrafts are not permitted on the accounts held at the Bank of Japan. Further, the Bank of Japan offers two settlement options. The first provides real-time, immediate settlement. The second option can be specified by the drawer for processing at certain

designated times during the day. The real-time transfers are irrevocable, but the designated transfers can be offset to nullify the original transfer orders. The clearinghouse system and Zengin System settle at 1:00 p.m., while the Gaitame system settles at 3:00 p.m. Concentrating settlement of transfer orders at designated times is implemented to minimize the costs arising from the difference in timing of settlements.

Offshore dollar clearing arrangements

U.S. based banks including Chase Manhattan and Bank of America operate offshore dollar clearing arrangements. The most important of these arrangements, Chase-Tokyo, serves financial institutions in Japan wishing to clear dollar-yen foreign exchange transactions, the dollar call money market in Tokyo, commercial transactions denominated in dollars, and any Japanese firm payment instruction which requires same day value for settling dollar transactions. Volume growth appears to be closely related to that of foreign exchange activity. The systems are multilateral and position netting systems with procedures similar to those of CHIPS and CHAPS. Thus, the same benefits/problems discussed for those arrangements are relevant. Operating procedures and time zone differences create significant settlement risk on offshore dollar clearing systems and, again, the position netting system is a less efficient form of netting than netting by novation.

In the case of Chase-Tokyo, dollar trading occurs during the Japanese business day with Chase keeping a running tally of positions. The end of (Japan) day positions of network participants are relayed to Chase's New York office at approximately 3 a.m. EST and subsequently it receives or makes payment to the participants' New York affiliates via the CHIPS network.

Securities transfers

The National Securities Clearing Corporation and Depository Trust Corporation

The National Securities Clearing Corporation (NSCC) is a self-regulated U.S. securities clearing agency which is jointly owned by the New York Stock Exchange (NYSE), American Stock Exchange (AMEX), and the National Association of Securities Dealers (NASD). The Depository Trust Corporation (DTC) is a bookentry securities depository and serves as an integral part of the NSCC's clearing and settlement process. Together the two provide a delivery

versus payment system which processes approximately 95 percent of all equities traded in the U.S. For a more comprehensive discussion of this and other clearing arrangements the reader is directed to the citations in the bibliography including Bankers Trust (1989b).

The NSCC receives trades from both the exchanges and market participants. The matched exchange trades are considered irrevocable and are routed to the NSCC's computer facility on the trade initiation date. Data from market participant trades are matched by the NSCC and routed for clearing the morning following the trade initiation date.

The NSCC provides bilateral position netting with trade guarantees. The netting reduces the flow of dollars and securities owed by approximately 80-85% resulting in reduced transaction costs and increased liquidity for the payments system. The NSCC also acts as the counterparty to every CNS trade, and guarantees all settlement obligations on midnight of the day the NSCC reports matched trades to participants. Dealing only with NSCC at settlement is believed to provide integrity to the clearing and settlement system.

Guaranteeing trades exposes the NSCC to risk and it, accordingly, has taken measures to control these risks. The creditworthiness of members is monitored by the NSCC's full-compliance monitoring system and the clearing members contribute to a guarantee fund to be used in the event of a member default. Also, the NSCC has a mark-to-market program for trades settled after the designated settlement date.

The International Securities Clearing Corporation

The International Securities Clearing Corporation (ISCC), founded in 1985, is a subsidiary of the NSCC. Its function is to clear and settle trades of stocks and bonds across national borders serving as an interface between U.S. participants and foreign clearinghouses and depositories. U.S. participants transmit data to the ISCC in a standard format, with the ISCC subsequently transmitting the information to the appropriate foreign clearing system in the required format.

Clearing and settlement procedures vary according to the particular foreign clearinghouse link which processes the trade. The ISCC provides trade guarantees for some, but not all links. Similarly, some but not all transactions are netted. The ISCC also serves as the interface between foreign clearing

and depository organizations and the NSCC/DTC. The ISCC sets up accounts at the NSCC and DTC for the foreign clearing houses and depositories. Additionally, the NSCC is the link to the NSCC for foreign brokers to clear and settle thirty international and global mutual funds.

Euroclear and Cedel

Euroclear and Cedel (Centrale de Livraison de Valeurs Mobilières SA), located in Brussels and Luxembourg, respectively, are two independent but related clearing and settlement systems which support the Euro-securities market. They are independent in that they are separately managed, compete with one another for similar business, and have different hours of operation. They are related in that they process similar Euro-securities for many common customers. For efficiency purposes, the two were bridged in December 1980 by having each system open an account with the other clearing arrangement. This enabled transactions between the two systems to be handled on a bookentry basis instead of requiring the physical movement of the securities. In theory this bridge account is treated in a manner similar to other accounts. Actually the systems cannot simply view each other as another customer because the large volume of securities moving between the two necessitates a special line of credit from third party sources and unique treatment of the finality status of security transfers. For additional analysis of the workings of the two systems see FRB-NY (1989a), Anderson (1981), Duffy (1987), and Ollard (1985).

The two systems are bilateral gross settlement systems. Transactions are settled on the appropriate settlement date if, and only if, the delivering party has clear claim to the securities and the receiving party has adequate cash or credit available to cover the transaction. A bond borrowing facility and credit facility is made available via banking relationships. The Brussels branch of Morgan Guaranty originated the Euro-clear system in 1968, sold 97 percent of it in 1972, and continues to have an active role in the daily operation of the system. It is also heavily involved in bond lending and the provision of credit for settling purposes.

Japanese Securities Clearing Corporation (JSCC)

The JSCC, established in 1971, is a wholly-owned subsidiary of the Tokyo Stock Exchange. The JSCC clears and settles domestic and foreign equity trades, a variety of bond trades, Tokyo Stock Price Index futures contracts (TOPIX), and government bond futures traded on the Tokyo Stock Exchange.

The JSCC controls and administers the clearing accounts of the 114 clearing members which are all Tokyo Stock Exchange members. In addition to the equity clearance system, a security lending facility is also offered to member firms through the JSCC and the Japan Securities Finance Co., Ltd.

The JSCC performs the security delivery portion of the delivery versus payment settlement process, and the transfer of title is completed through its electronic Book Entry Clearing System. The payment side of the transaction is handled by the Clearing Administration Department--a division of the Tokyo Stock Exchange. Neither the JSCC nor the Clearing Administration Department provide trade guarantees, therefore, they bear minimal risk. However, a 5 billion yen compensation fund is maintained as a "last resort" facility in case of catastrophe.

The TSE clearing system functions on a net basis, thus saving the clearing members transaction expense. Clearance and settlement is normally a three day process but failures are given an additional four business days to settle. Low tolerance of settlement failures on the appointed date is exemplified as broker-dealers assess an interest penalty to defaulting parties. To date, there has never been a settlement failure under this four day extension.

In May 1984, Japan passed the "Law Concerning Central Depository and Book-Entry Delivery for Share Certificates and Other Securities." The legislation was intended to address the increasing risks experienced by market participants due to increased trading activity. One objective of the legislation was to create a bookentry system to immobilize securities and enhance the efficiency in the security delivery process. Specifically, as a result of the legislation, the Japan Security Depository Center (JASDEC) was established as a central security depository to assist the JSCC in the clearance and settlement process of domestic stocks. It is anticipated the JSCC and JASDEC combined will function similarly to the NSCC and DTC in the U.S. JASDEC was scheduled to be operational in 1991.

Table 1

Foreign transactions in domestic bond markets:
amount and share of domestic trading

	1985		1988	
	\$billions	share	\$billions	share
Japan	197.9	5%	558.7	4%
Canada	43.4	16	104.3	28
Germany	55.6	17	349.8	53
U.S.	295.5	19	587.8	29

SOURCE: Various central bank statistical releases.

Table 2

International equity markets
(billions of dollars)

	Foreign transactions in U.S. securities in U.S. markets	Foreign transactions in foreign securities in U.S. markets	Total
1982	79.9	15.7	95.6
1983	134.4	30.2	164.6
1984	62.2	15.8	78.0
1985	159.0	45.8	204.8
1986	277.5	100.2	377.7
1987	481.9	189.3	671.2
1988	364.1	151.4	515.5

SOURCE: Federal Reserve Bulletin, various issues.

Table 3

Transactions in foreign securities by U.S. residents
(\$ billions)

	Equities	Bonds
1982	16	66
1983	30	76
1984	31	119
1985	45	170
1986	100	337
1987	188 ^e	380 ^e

^eestimate

SOURCE: Survey of Current Business, U.S. Department of Commerce various issues.

Table 4

Moody's bond ratings--selected banks

Institution	Previous Rating	Revised Rating
Bankers Trust Corp (holding company)	Aa3	A1
Bankers Trust Company (lead bank)	Aa1	Aa2
Citibank (lead bank of Citicorp)	Aa2	Aa1
Chemical Bank	A2	Baa1

Revised ratings were effective February 1989.

Table 5-a

Number of contracts traded on Eurodollar CD futures
and selected foreign futures contracts
(in thousands)

FUTURES CONTRACT VOLUME

	1984	1985	1986	1987	1988	1989
Australian Dollar					99,948	118,702
British Pound	1,444,492	2,799,024	2,701,330	2,592,177	2,646,849	2,545,160
Canadian Dollar	345,875	468,996	734,071	914,563	1,418,065	1,270,192
Deutschemark	5,549,150	6,620,223	6,795,907	6,168,972	5,813,868	8,326,020
Japanese Yen	2,334,764	2,415,094	4,081,116	5,454,578	6,701,474	8,190,280
Swiss Franc	4,129,881	4,758,159	4,668,430	5,268,276	5,363,232	6,156,064
French Franc					3,932	2,030
Total Foreign Exchange	13,804,162	17,061,496	18,980,854	20,398,566	22,047,368	26,608,448
Eurodollar	5,248,531	10,488,514	12,388,763	23,682,773	25,237,481	46,846,982
U.S. T-Bond	30,130,943	41,079,396	54,183,691	68,413,062	73,764,578	72,611,890

Table 5-b

Open interest on Eurodollar CD futures
and selected foreign exchange futures contracts
(in thousands)

FUTURES CONTRACT OPEN INTEREST

	1984	1985	1986	1987	1988	1989
Australian Dollar					1,519	2,557
British Pound	18,385	25,082	23,145	28,589	16,442	20,208
Canadian Dollar	7,058	13,929	14,937	14,908	22,062	23,573
Deutschemark	35,506	53,830	44,911	35,502	36,572	58,987
Japanese Yen	14,083	28,058	23,868	44,524	33,840	50,971
Swiss Franc	18,920	27,351	23,138	24,298	21,956	32,698
French Franc					59	25
Total Foreign Exchange	93,952	148,250	129,999	145,821	132,450	189,019
Eurodollar	95,673	141,831	251,830	332,960	588,827	671,853
U.S. T-Bond	203,866	303,048	233,297	268,361	373,972	295,446

Table 6**Sources of nighttime transactions demand in the foreign exchange market**

Settlements arising out of dollar/yen trading

Gross value of trades	162
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(based on BIS survey)

Only 50% would remain after bilateral netting	81
---	----

Only 5% would remain after multilateral netting	8
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Joint settlement of all currencies after multilateral netting

Gross value of global forex trades	650
------------------------------------	-----

Of which 5% would remain after multilateral netting	33
---	----

Table 7**Projected total demand for nighttime transactions**

	billions of dollars
Book entry securities	26
Dollar settlements of yen trading	0 - 81
Derivative products	3.8
Off-shore dollar clearings	?
Total	30 - 110

Table 8

Impact of various proposals for nighttime payments

Proposal	Financial Activity					
	Derivative products	Interbank FX with bilateral netting	Interbank FX with multilatered netting	Offshore dollar payment	Cross border securities lending	U.S. government securities
1. Nighttime intrabank transfer	useful for initial margin or collateralizing a mark-to-the market	none	none	none	none	none
2. NIPS	variation or initial margin	reduces temporal risk	improvement only in limited circumstances	reduces temporal risk	none	none
3. 24 hour mutual fund	initial margin	none	none	none	eliminate temporal risk and gives investment opportunity	substitute for T-Bills
4. Central Bank net settlement	improves on NIPS	improves on NIPS	reduces temporal risk	reduces temporal risk	none	none
5. Midnight Fed with book entry securities transfer	improves on NIPS	small improvement over 2 & 4	small improvement over 4	small improvement over 4	eliminate temporal risk and gives investment opportunity	allows immediate transfer
6. Central bank settlement foreign currency	facilitates delivery and margining in foreign currencies	allows for DVP but on a very limited scale	allows for DVP but on a very limited scale	no improvement over 5	eliminate temporal risk	permits DVP with foreign currencies
7. Central switch for central banks	some improvement over 6	permits full scale DVP	permits full scale DVP	no improvement over 5	permits DVP for securities on central bank book entry systems	permits full scale DVP with foreign currencies

Source: see text

Table A-1

Financial transactions through CHIPS and FedWire
by type of transaction*
(\$ millions)

	CHIPS		FedWire	
	No. of transactions	Dollar Amount	No. of transactions	Dollar Amount
Securities purchase/redemption/financing	274	2,842	4,458	54,856
Bank loan	399	3,476	272	3,956
Federal funds	107	788	3,361	66,269
Commercial and Misc.	1,295	12,793	2,690	33,593
Settlement	945	16,198	915	18,664
Eurodollar placement	4,800	56,255	966	18,848
Foreign exchange	20,674	112,505	173	858
Total	28,494	204,857	11,836	197,043

*Estimated aggregate transactions based on subsample survey.

SOURCE: "Large-Dollar Payment Flows from New York," FRB-NY Quarterly Review, Federal Reserve Bank of New York, Winter 1987-88.

Table A-2

CHAPS volume

<u>Year</u>	<u>Volume (000s)</u>	<u>Value (Millions)</u>	<u>Average Transfer Value</u>
1984	1,149	741,273	645,146
1985	2,217	2,355,565	1,062,501
1986	3,161	4,143,877	1,310,939
1987	4,386	7,331,906	1,671,661
1988	5,781	11,288,501	1,952,690
1989*	7,000	15,500,000	--

SOURCE: Allsopp (1989). 1989 figures are approximations based on first quarter data and previous growth trends.

Federal Reserve Bank of Chicago

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