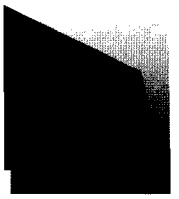
Payments system issues in financial markets that never sleep

Herbert L. Baer and
Douglas D. Evanoff



Financial market participants rely heavily on the payments system to control risk arising out of the trading or exchange process. Because of this reliance, changes in the nature of financial transactions may necessitate changes in the payment systems that support them.

The last decade has witnessed a dramatic change in the nature of financial transactions. In particular, today's financial markets are globally intertwined and function on a 24-hour basis. For example, foreign currency trading has been growing at nearly 40 percent annually. The resulting risks associated with the settlement of foreign currency contracts are perceived by many market participants to be significant. Major changes are also occurring in the futures and options markets, which may lead to increased payments activity during nontraditional hours. The Philadelphia Stock Exchange and the Chicago Board of Trade have introduced nighttime trading hours, and the Chicago Mercantile Exchange is promoting the introduction of its GLOBEX system, which will allow electronic trading at night. Moreover, the customer base for these instruments is significantly more international today than it was five years ago. During this same period, foreign countries have developed competing exchanges on which many U.S. customers desire to participate. Finally, the growth of cross-border holdings of securities, and the associated increase in the demand for cross-border security lending, will also create a demand for changes in the payments system.

Given the changing financial markets, many market participants and central bankers are concerned that existing payment systems do not provide adequate means for market participants to control the risks emerging from these transactions. In particular, while an increasing number of financial markets operate on a 24-hour basis, national payment systems generally continue to operate for eight hours a day. This makes the control of certain types of risks difficult and costly. This paper describes the types of risks that are encountered in financial transactions, discusses how changes in payment systems can be used to control or eliminate these risks, and provides estimates for the demand for nighttime operation of a dollar-based payment system. The final section summarizes and offers policy options.

Risks and payments systems: An overview

Trading financial contracts creates two types of risk. *Market risk* arises because a party to the contract may incur costs when seeking to replace a defaulted agreement because the market value of the contract has changed. *Delivery risk* (or principal risk)

The authors are assistant vice president and senior economist, respectively, at the Federal Reserve Bank of Chicago. Helpful comments on earlier drafts by John Davidson, George Juncker, John McElravey, John McPartland, Jeffrey Marquardt, Larry Mote, Janet Napoli, Patrick Parkinson, and Don Wilson are acknowledged. The authors also thank the numerous individuals who participated in background interviews. However, the views expressed are those of the authors and may not be shared by others.

arises because one party may default on a contract after the other has already performed its obligations. By moving cash and collateral, netting payment obligations, and facilitating settlement in a delivery vs. payment network, the payments system allows market participants to manage these risks.

While financial instruments are increasingly being traded on a continuous basis around the world, payment 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, and risk would be managed, in a world in which transaction costs were unimportant. In this world, trades could be instantly transmitted to the clearing system. Any credit exposure due to market risk could be instantaneously eliminated through posting cash or collateral on a real-time basis. Any delivery risk could be eliminated through the use of delivery vs. payment mechanisms. (Payment system risk definitions and means to manage risk are presented as background material in the Box).[1]

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 either awkward or impossible. Procedures to counteract the resulting risk on transfer networks have frequently not been adopted. Delivery risk is also substantial in many markets, and the development of formal netting agreements and effective delivery vs. payment mechanisms to counteract this has not occurred.

Below we detail potential payments problems that are emerging as a result of the rapid growth of cross-border trading of securities, interbank trading of foreign exchange obligations, cross-border and nighttime trading of derivative products such as futures and options, and offshore clearing of dollar payments. As these problems are analyzed, we also attempt to reflect the likely impact of anticipated market changes such as adjustments to procedures on CHIPS (Clearing House Interbank Payments System), the introduction of delivery vs. payment arrangements, and the introduction of multilateral netting of foreign currency contracts.[2]

International securities trading

Cross-border secondary market trading of U.S. government securities has grown rapidly—in recent years the average annual growth rate has been 22 percent (Pavel and McElravey 1990)—and is now conducted on a 24-hour basis.[3] In 1988, trading by nonresidents in these securities reached $3 trillion, or roughly $12 billion per day. Nighttime trading of Treasury securities is also becoming more important. 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 take place during these hours. This would suggest a daily nighttime volume of U.S. government securities trading of approximately $53 billion. This growth has led to the development of off-hours trading of Treasury bond futures contracts at the Chicago Board of Trade (CBOT), the Tokyo Stock Exchange, and the London International Financial Futures Exchange (LIFFE). In response to this growth in 24-hour trading of U.S. government securities, the Public Securities Association has recently announced a plan to disseminate pricing data on a 24-hour basis. Although the current volume of trading in private securities is much smaller, that market has registered more dramatic growth rates. Foreign transactions in private sector U.S. bonds currently approach $640 billion per year, and trading volumes have increased at an average annual rate of approximately 80 percent.

Similar trends have been observed in other countries (see Table 1). In Germany, for example, bond transactions have increased at a 43 percent annual rate over the 1985-89 period and accounted for over one-third of the value of all transactions in German bond markets. Foreign investment in equity markets has also increased dramatically. For instance, foreign transactions in U.S. markets grew at nearly 30 percent annually to $650 billion in 1989 (see Table 2).

To a significant extent, the growth in cross-border trading is likely to create relatively few demands on the global payments system that cannot be handled by existing

Payments system risk and means to manage it

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 existing payment systems, as well as the implications of proposed changes, it is necessary to have an understanding of the nature of the risks involved and means to address them. We briefly discuss these aspects of payment and clearing arrangements, and in the process introduce the terminology used throughout the article.

The major risks involved with financial transactions are liquidity, credit, and systemic risk. *Liquidity risk* results from the possibility 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 separated 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*, the risk that one party will fulfill his settlement obligations while the counterparty does not. Unlike market risk, delivery risk applies to the gross value of the obligation. It is a major problem in cross-border or multicurrency transactions.

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 securities or derivative products market it is manifested in a cessation of trading through conventional channels. Although regulators are concerned with risk in general, it is systemic risk that concerns them most and that drives most policy decisions.

Market participants have developed certain practices to control payment system risks and costs. For example, in certain markets, such as foreign exchange, participants have a large number of contracts with one another that may be offsetting over the course of the trading day. To reduce transaction and accounting costs on the delivery day, the parties may use a *position netting* procedure in which the net position of parties is summarized. One payment covering the net position therefore replaces all the individual transactions. Position netting can be either bilateral (between any two parties) or multilateral (a single net position between all market participants). However, position netting does not reduce risk. Risk can be reduced when netting procedures are employed by introducing *novation.* With this legal device, each trade creates a new contract or obligation for the resulting net position and previous contracts are discharged. Thus, participants are contractually obligated to a running position. To further reduce risk and potential counterparty squabbles, market participants can have the entity that serves as the central accountant in the multilateral netting arrangement (frequently a clearinghouse) substitute as a counterparty for all trades. Thus, with multilateral netting with novation and *substitution,* market participants trade with indistinguishable counterparties, are legally obligated to the substitute for the net position owed as a result of trades with all participants, and delegate risk management to the substitute.

The lag between initiation and final settlement of the transaction, especially troublesome in cross-border transactions, can increase liquidity, market, and delivery risk. This can be eliminated by introducing *delivery vs. payment structures* in which both sides of the transactions occur simultaneously. This would be particularly useful in the cross-border trading of securities where depositories can be created that house the securities and act in conjunction with the payments system to transfer payment and ownership simultaneously. Other commonly used payments system risk-management tools include frequent scrutiny of the financial viability of clearinghouse participants, limits or caps on intraday exposure to individual counterparties or groups of counterparties, and collateralization of debit positions.

TABLE 1

Foreign transactions in domestic bond markets
(billions of dollars)

	1985	1989
U.S.	1263.5	4835.3
Government sector	968.0	4153.7
Private sector	295.5	681.6
Canada	43.4	134.7
Germany	55.6	366.6
Japan	197.9	527.2

SOURCE: Various central bank statistical releases.

TABLE 2

Foreign transactions in U.S. equity markets
(billions of dollars)

	Transactions in U.S. securities	Transactions in foreign securities	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	364.4	152.7	517.1
1989	416.7	232.4	649.1

SOURCE: Federal Reserve Bulletin (1990).

institutions and arrangements. Participants in these markets typically have several days to complete the settlement process. Consequently, problems commonly associated with moving cash between parties in some financial transaction arrangements are generally unimportant in these markets. Indeed, because securities traded through exchanges are generally subject to netting, these markets account for a relatively small portion of international payment activity. For markets with a netting mechanism in place, the major problem involves 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 recommendations to move from a five-day to a three-day settlement of securities transactions, limits on the timely movement of cash will not in general be a constraining factor.[4]

The timely movement of funds may become a problem, however, in payments associated with the lending of securities to facilitate settlement and the delivery of U.S. government securities. It is becoming increasingly common for U.S. and foreign investment banks to borrow securities from U.S. institutional investors. Typically, these investors seek immediate reinvestment of the proceeds of the transaction in dollar-denominated assets and are not interested in maintaining a large number of offshore 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 length of time. Under the current system, securities lent to facilitate settlement in Tokyo are particularly troublesome, since "good" or "final" dollars do not flow into U.S. accounts until 5 p.m. eastern time the next day (via CHIPS).[5] While there are no hard numbers, several financial firms indicated in interviews that these types of transactions had grown significantly in the past two years. Payments arising from the settlement of these transactions could be as high as $1 billion a day. The proposed three-day settlement deadlines for securities transactions 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 also may be inadequate to meet the needs of the international marketplace. Unlike other markets 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 structure of the settlement process in the U.S. government securities market arises in part from the fact that it provides an excellent source of liquidity. This means that settlement procedures in the Treas-

ury market are more focused on providing rapid availability than on minimizing transaction costs through netting. Because Treasury securities are used as short-term investment vehicles, the growing importance of trading in Treasuries at night may also be 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 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. It has been growing at approximately 40 percent annually during the 1980s (Pavel and McElravey 1990).

Foreign exchange products—such as spot, forward, option, and swap instruments—specify a settlement or "value date" in the future on which the exchange of currencies will be completed. Spot contracts are usually value-dated two days from the initiation date. Forward, option, and swap transactions are value-dated for longer periods, as specified by the transacting parties. These foreign exchange transactions are initiated through informal, over-the-counter interbank markets. 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.

Today, most foreign exchange obligations are subject only to position netting (not novation). This occurs when final delivery instructions are entered into the relevant payments system (for example, CHIPS for the dollar leg of a transaction). The reliance on position netting and the lack of delivery vs. payment leaves market participants with temporary exposures which are large relative to their capital. This risk is particularly important in settling dollar-yen transactions because of the 14-hour gap between the final payment of yen in Tokyo and the final payment of dollars in New York. One way to reduce this delivery risk is to close the settlement gap by making it possible to transfer dollars and yen simultaneously.

Another way to reduce delivery risk is to introduce netting by novation. The foreign exchange market has several characteristics that make it a candidate for the introduction of netting by novation. The largest participants enter into numerous transactions that ultimately offset one another. As a result, gross exposures are often large relative to the participating banks' capital, exposing banks to delivery risk. Since the net exposures are small, much of this risk could be avoided if netting by novation were implemented. Given the large number of value dates, currencies, and participants, multilateral netting would lead to greater reductions in transactions volume and risk than would bilateral approaches. 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 assess accurately its exposure to other parties.

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, because the system does not provide delivery vs. payment, it only reduces delivery risk and does not eliminate it. The major benefit of FXNET is that it should significantly reduce transaction volume—by an estimated 50 percent (Bartko 1990)—which could lead in turn, to significant reductions in transaction costs and both liquidity and credit risks.

A multilateral netting procedure would reduce the costs of foreign exchange transactions even more. With this arrangement losses are allocated according to a pre-arranged formula. Risk levels are controlled by setting strict entry requirements and demanding frequent demonstrations of financial 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 clearinghouses have enforced strict entry requirements and margin requirements, and stand as the counterparty to all trades. Simulations conducted in 1990 by International Clearing Systems and 13 banks suggested that multilateral netting by novation would reduce the credit risk associated with

foreign exchange trading by 70-75 percent. It was projected that payment transactions would be reduced by more than 95 percent.

What has worked so well for the futures market, however, may not apply to other markets. Conversations with investment bankers and large international bankers concerning the various netting proposals for foreign exchange activity suggest that they see these netting schemes as a leveling influence that would reduce the advantage of firms doing the best job of evaluating and bearing risk. Moreover, some firms are concerned that these proposals place them in the undesirable position of being unable to control or monitor counterparty risk. As a result, some of the major firms may be unwilling to sacrifice their ability to evaluate and select counterparties individually.

Recent proposals for multilateral netting 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 will protect the competitive advantage of those members with greater expertise in risk analysis.

On the surface, the delivery risk associated with the settlement of foreign exchange trades would appear to make this market an important factor in any decision to extend existing payments system hours. However, the adoption of multilateral netting would significantly reduce this delivery risk, in turn reducing the need for extended hours. Nevertheless, should multilateral netting systems fail to develop, demand for improvements to the existing payment services would increase.

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 interest rates, 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 specified 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 international financial products (see Table 3). For example, futures contract trading on Eurodollar interest rates increased almost 55 percent annually since 1984, reaching almost 47 million in 1989. Moreover, combining futures and options, nearly 40 million contracts on various foreign currencies were traded worldwide in 1988, up from 14 million in 1983.[6] Open interest, which is more closely associated with clearinghouse risk and payments, has also grown (see Table 4).

Globalization has also led 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 worldwide total to 72 (*Euromoney* 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 on many exchanges is considerable. For example, over two-thirds of LIFFE's members are 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 and McElravey 1990).

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

TABLE 3

Futures contract volume

Number of contracts traded on Eurodollar interest rate futures and selected foreign exchange futures contracts

	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

SOURCE: Futures Industry Association.

the CBOT have already been expanded to provide greater overlap with the London and Tokyo business days.

Settlement procedures in futures markets

Derivative product markets control the credit risk created by the lag between initiation and settlement of contracts through the use of netting by novation, initial margin, variation margin, and loss-sharing arrangements.[7] 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 existing 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 prefer a rapid, reliable electronic payments system to facilitate the transfer of "good" variation margin.

A futures clearinghouse also collects *initial margin* from all clearing members which, in turn, collect initial margin from their customers. This margin is employed to guarantee that counterparties meet their contractual obligations to make variation margin calls. Currently, initial margin must first be posted in cash; however, it may later be replaced with acceptable securities or standby letters of credit. In principle, there is no reason why initial margin could not be met by posting acceptable securities or standby letters of credit. Thus, futures clearinghouses need not be dependent on the payments system to receive initial margin payments.

Settlement procedures in options markets

In options markets cleared by the Options Clearing Corporation (OCC), the distinction between variation and initial margin is not so clear. 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, that is, the value of contracts sold. The process is similar to that employed in the futures market. First, payments to meet increased margin requirements are made with cash, securities, or standby letters of credit. Second, short positions are marked to market daily. If the short position suffers a loss, addi-

TABLE 4

Futures contract open interest

	Open interest on Eurodollar interest rate futures and selected foreign exchange futures contracts					
	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

SOURCE: Futures Industry Association.

tional 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.

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—and in many cases are—made with securities and standby letters of credit rather than cash. However, OCC clearing members frequently find it convenient to post securities and standby letters of credit *after* cash has been supplied. 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.

Variation margin in derivative products in a global market

Derivative product exchanges located in the United States 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 increased 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 having U.S. depositories execute securities transfers 24 hours a day. The problem of effecting settlements during nontraditional 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 payment systems may be making it difficult for U.S.

exchanges to penetrate further into 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 United States. Where this was not the case, payments problems were typically resolved using foreign exchange services provided by the clearing member. Because of the smaller size of the typical U.S. customer and the deficiencies of many foreign payment systems and money markets, 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.

Round-the-clock trading creates additional problems for futures clearinghouses and their members. For example, the substantial overnight price movement in a number of contracts creates the potential need for intraday margin calls between 5:00 p.m. and 7:00 a.m. eastern time. Indeed, the yen-dollar contract experiences more price movement overnight than during the U.S. business day (Lane 1989). Therefore, the ability to levy a nighttime margin call would be particularly useful for these contracts. However, the margin call could be completed only if the relevant institutions (U.S. banks) and their payment system were open during nighttime hours and had a means of transferring value. When the payments system is not operating, a clearing member would be exposed to increased risk commensurate with the additional time necessary to complete the margin call (that is, the additional time to confirm the customers' ability to cover their positions).

Derivative product markets can and do function at night even though the clearinghouses lack the ability to levy margin calls and receive payments during these hours. However, a large nighttime price move would create significant credit exposures between clearing members or between clearing members and their customers. If the resulting exposures were large relative to the resources of the clearinghouse, trading would slow and perhaps cease as clearing members became unwilling to bear additional clearinghouse risk. Trading would resume only after the existing credit risk had been eliminated by the transfer of cash or securities from losing clearing members. Such a trading halt would be the market-based analog to a regulatory circuit breaker. This market-induced trading halt, like its regulatory counterpart, would be a nuisance rather than a disaster once the payment system opened, since payments and settlement would still take place.[8] However, to the extent that such halts are the result of deficiencies in payment systems, market participants can be made better off by altering payment practices.

In summary, as the trading hours and customer bases expand in derivative product markets, the desire to move margin monies around the world and around the clock will increase. This in turn will lead market participants to seek ways to execute cross-border variation margin calls outside of traditional business hours. 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

Offshore dollar clearing arrangements have been introduced in foreign countries to meet the demand of local institutions for dollar transactions with (local) same-day value. U.S. banks commonly serve as the clearing entity—they determine positions of the participating parties and serve as the settling bank once the U.S. markets open. Given the trend toward globalization and the imposition of daylight overdraft limits on U.S. domestic transfer networks, the role of offshore dollar clearing arrangements may increase in the future. It was this potential which lead the Federal Reserve to issue its policy statement emphasizing the need for risk control measures on these arrangements (Board of Governors 1989).[9]

These clearing arrangements involve additional risk when the operating hours of the host country's banking system do not overlap with the U.S. banking day. The resulting local same-day value is essentially a credit extension by the settlement bank. For example, these arrangements commonly have transactions netted and "provisionally" settled during the local business day, with final settlement in "good" funds at the end of the U.S. business day through the account of the U.S.-based clearing bank via CHIPS. Although a loss-sharing arrangement may be in place, there may be no collateral backing the agreement,

and nothing dictates that the positions are legally binding, although customers may act as if they were. This may be particularly troublesome during times of crisis. If settlement were to occur over CHIPS, the clearing bank could face significant problems if a participant in a debit position failed to make payment before the end of the U.S. banking day. The bank probably would have already initiated irreversible credits on CHIPS (to the remaining clearing arrangement members) and may have difficulty meeting its settlement requirements. Thus, CHIPS' settlement could be impaired. Alternatively, the clearing bank could provide the necessary credit and, during the next business day, could request that participants unwind credits received the previous day. While small reversals may be made to maintain the dollar clearing 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, the lack of overlapping business hours creates account overdrafts and temporal risk for the U.S. bank organizing the dollar clearing arrangement.

Improvements could be made in the current clearing arrangements. First, legally binding agreements that make the allocation of credit and liquidity risk explicit and which guarantee finality could be initiated. The guarantee could be backed by collateral or the capital of the participants. Movement toward this goal appears in prospect on some of the arrangements. Second, adjustments to the payments system could be introduced so that a dollar-based funds transfer network with finality operates during the U.S. nighttime hours. This would directly address problems evolving from the lack of overlapping business days.

Nighttime transactions and the potential demand for payments activity

Emerging stresses on the global payments system arise from several sources: the increasing importance of cross-border securities lending, growth in the nighttime trading of U.S. government securities, significant risk in the foreign exchange markets resulting from the lack of netting or delivery vs. payment mechanisms, rapid growth of offshore dollar clearings, and the attempt by futures and options exchanges to expand their trading hours and customer base.

The objectives in evaluating alternative ways to improve current means of transferring value during nontraditional U.S. banking hours are twofold: to increase efficiency and to improve risk management. Since the level of risk resulting from payments activity during these hours is closely correlated with payment volume, the demand for nighttime transactions is thought to depend critically on the level of activity in the nighttime market.

What is the current level of demand for nighttime transactions? We attempt to generate a rough estimate based on the assumption that the bulk of the activity will be generated from the sources discussed above.

As noted earlier, there are no publicly available estimates of the volume of off-hours trading in Treasury securities. However, reasonable approximations can be generated. If we assume that the hourly ratio of nighttime to total trading is the same for the cash securities as for the futures contracts, then we can project that approximately 15 percent of total trading in Treasury securities occurs at night. However, only a portion of these transactions would be for same-day settlement. The general rule-of-thumb is that about 50 percent of transfer instructions received by the Federal Reserve are for the settlement of trades made earlier in the day. Given this assumption, 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. On a typical day the derivative product markets create perhaps $12 billion in payments traffic.[10] Typically about 70 percent of this represents variation margin with the remaining portion meeting initial margin requirements. During times of extreme volatilility like October 19, 1987, total payments volume associated with the derivative markets might well exceed $30 billion. However, only part of this total would shift to nighttime trading.

Based on Chicago Board of Trade experience, nighttime trading constitutes about 15 percent of daytime volume. Thus, we could expect that payment of initial margin associ-

ated with the opening and closing of positions would approximate 15 percent of the current daily total of approximately $3.6 billion—or $500 million. Since average nighttime price movements for derivative products is about 40 percent of the total daily movement (Lane 1989), nighttime variation margin payments would approach 40 percent of the daily total of $8.4 billion—or $3.3 billion. Summing these two components, the total nighttime payments arising from margin calls would be approximately $3.8 billion. A more conservative scenario, and perhaps more realistic, would have payments restricted to transactions between the clearinghouses and their clearing members and would exclude payments between clearing members and their customers. These payments, which would only encompass variation margin calls, currently account for approximately 20 percent of the total $3.8 billion variation margin. This would produce a conservative nighttime estimate of approximately $800 million. 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. Demand will depend critically on whether, and how, multilateral netting is introduced into this market. 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. eastern time) 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, therefore, the primary source of nighttime foreign exchange transactions would be contracts involving the Japanese yen. The Bank for International Settlements (1989) estimated that dollar-yen trading averaged $162 billion a day in 1989. Of this, perhaps $25 billion is netted away through existing 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. The introduction of bilateral netting on a currency pair basis could reduce the $162 billion to $81 billion (Bartko 1990). Since bilateral netting should 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 dollar-yen 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. To eliminate delivery risk completely, all currencies would need to move at the same time. A logical time for this to occur would be early in the U.S. morning when the other two payments systems are open. However, even this would require changes in payments system practices in Europe and Japan. With global foreign exchange trading currently running at $650 billion a day, multilateral netting would reduce the daily dollar settlement by 95 percent to roughly $32.5 billion.

Summing these sources of demand, estimated nighttime transactions would run somewhere between $27 and $110 billion a day, depending on the assumptions employed (see Table 5).[11] The lower figure is comparable to the Federal Reserve's 1968 electronic funds transfer volume; in today's terms, it equals approximately 2 percent of current volume on CHIPS and FedWire combined. However, if past growth trends are any indication, we can expect transaction volume to increase substantially in the future.

Summary and policy implications

During much of the 24-hour day, financial market participants find it difficult or impossible to eliminate market risk by transferring cash or collateral. In many cases participants do not have the option of settling transactions on a delivery vs. payment basis. Additionally, in contrast with domestic transactions, it is difficult for participants to limit the delivery risks inherent in international transactions by having settlement occur relatively soon after

TABLE 5

Potential nighttime transaction demand
(billions of dollars)

Treasury securities	26
Derivative products[a]	.8 to 3.8
Foreign exchange[b]	0 to 81
Total	26.8 to 110.8

[a]The low end of the range assumes that the only payments made are between the clearinghouse and its members; the high end assumes that clearing members attempt to collect from and pay to customers at night.

[b]The low end of the range represents the case of multilateral netting with delivery vs. payment implemented during daytime hours; the high end represents an environment with bilateral netting and nighttime settlement of dollar-yen transactions only.

NOTE: See text for citations.

the initiation of payment. Ten years ago these problems were less important. However, the financial markets have changed significantly since then. 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 many corresponding changes in the payments system.

This study has reviewed trends in the flow of international payments, the characteristics of existing payment system arrangements, and the problems inherent in these arrangements. Such recent changes in payment system practices as the movement toward netting arrangements and implementation of loss-sharing agreements allowing for settlement finality will lead to significant cost savings and reductions 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. Discussions with financial market participants as well as estimates based on what we believe to be realistic assumptions suggest a 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 $27 and $110 billion a day, or 1.5 percent of current daytime volume. Even at the low end of this range, the resulting risk from using current payments arrangements is thought by many market participants to be significant. Additionally, the evidence suggests that in the future, transactions during this period will continue to increase.

How can the demand for these transactions best be met? In our opinion, the bulk of the solution 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 implemented efficiently and effectively, the private sector needs the tools to manage nighttime risk. The central bank has the ability to provide those tools without distorting the marketplace. Thus, a combination of public and private sector initiatives would appear to be appropriate. This approach is based on two propositions. First, the private sector has demonstrated that it has both the ability and incentives to evaluate and to manage risk, and an incentive structure that balances the benefits of risk reduction against its costs. Second, as a result of investments made to service daytime demand, the Federal Reserve may well have a cost advantage in providing the tools to manage nighttime risks. Likely private sector initiatives include the extension of netting by novation and substitution to new markets, the creation of new clearinghouses, improved finality on private sector payments arrangements, and extended operating hours for private payments systems and securities depositories. Likely central bank initiatives include additional net settlement services and extended hours of operation for funds and securities transfer systems.

By opening the book-entry and funds transfer services earlier and offering an additional early net settlement service, the Federal Reserve would make it possible for private sector transfer networks to decrease temporal risk.[12] While proposed plans to enhance the degree of finality on private transfer networks should reduce the need for FedWire finality, offering the additional settlement could decrease the monitoring cost incurred by banks

in controlling temporal risk. These risks would otherwise exist until settlement at the end of the day on FedWire.

Market participants may advocate the extension of *existing* daytime Federal Reserve services to cover the full 24-hour day. However, we believe this approach has at least two problems. First, should the central bank simply expand *existing* operations to the nighttime market, there would be significantly less incentive for the private sector to make needed changes in its operations. Second, we know that the central bank's presence in the provision of payments, if not properly structured, can distort market behavior and can lead to the creation of excessive risk exposures. However, having a *modified* version of FedWire and book-entry services operating *in conjunction* with private firms during the nighttime hours may still be desirable, given that it already operates during the daytime.[13]

Any extension of Federal Reserve hours, however, should be preceded by the implementation of modifications to eliminate the distortions induced by current operating 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. Of course, strong consideration should be given to making these changes even if the Federal Reserve continues to operate only in the daytime market. At issue, obviously, and a topic beyond the scope of this paper, is whether or not the central bank should have an operational presence in the daytime market.

FOOTNOTES

[1]For a more complete description of payments system risk and costs and alternative means to manage them, see Bank for International Settlements (1989), Parkinson (1990), or Baer and Evanoff (1990).

[2]CHIPS is a private clearing system located in New York and operated by the New York Clearinghouse Association. It is a dollar-denominated network specializing in international payments. Payments undergo multilateral position netting (without novation) and settlement occurs at the end of the U.S. day over the books of the Federal Reserve Bank of New York. CHIPS is currently taking steps to improve its risk management procedures.

[3]The reader is referred to Pavel and McElravey (1990) for a more complete discussion of recent trends in international financial activity.

[4]A report by the Group of 30 (1989) recommended the proposed change. The report also seeks the creation of delivery vs. payment settlement systems where feasible and encourages securities lending as a means of expediting settlement.

[5]By "good" or "final" funds we mean the security of receivers that funds transferred to them via electronic transfer networks will actually be delivered. The degree of security depends on the characteristics of the sender and the network on which the funds were transferred. For example, funds transferred over FedWire are considered "final" because the Federal Reserve guarantees them. Thus, to the extent the Federal Reserve can and will deliver on the guarantee, the transfer is considered final. Other networks may declare all transfers final, but the claim is only as good as the credibility of the network.

[6]See Pavel and McElravey (1990).

[7]For a discussion of the various settlement systems in the derivative product markets, see Rutz (1988).

[8]See Moser (1990) for a discussion of circuit breakers for the U.S. stock market and financial derivatives market.

[9]When daylight overdraft caps were originally placed on CHIPS and FedWire there was concern that certain business and payments activities would shift offshore. Partly in response to this concern, the Federal Reserve issued its policy statement

[10]The $12 billion figure and the other percentages used in this analysis are approximations based on discussions with several bank and clearinghouse representatives; alternative sources suggest similar figures.

[11]No publicly available information exists on the dollar flows through offshore dollar clearing arrangements. Since our estimates cover a relatively broad range it is doubted that the exclusion of this sector appreciably affects our projections.

[12]These alternatives are currently being evaluated by the Federal Reserve System.

[13]For a more thorough discussion of policy options to manage payments system risk, see Baer and Evanoff (1990).

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