R. Alton Gilbert

R. Alton Gilbert is an assistant vice president at the Federal Reserve Bank of St. Louis. Dawn M. Peterson provided research assistance.

Payments System Risk: What Is It and What Will Happen If We Try To Reduce It?

BOTH commercial banks and the Federal Reserve assume a certain amount of risk in participating in the payments system. This paper provides an introduction to payments system risk and the public policy issues involved in limiting the risk. Using simple balance sheet entries to illustrate, the paper will examine how policies intended to reduce payments system risk would affect banks and bank customers.

PAYMENTS SYSTEM RISK: WHAT IS IT?

Many banks overdraw their reserve accounts at the Federal Reserve during part of each business day as they process payments within the payments system. The Federal Reserve is concerned about the extent of this intraday credit for several reasons. First of all, since it does not charge interest on the intraday credit it extends, it is providing this overdraft facility at no cost to banks and, thus, may be overused by banks. Second, and more important, it is possible, though unlikely, that a bank could fail while its reserve account is overdrawn. In this event, the Federal Reserve would become a general creditor of the failed bank. Finally, the Fed is concerned with the risk that banks assume through their participation in private wire transfer systems. Current Federal Reserve policy is designed to limit the risk assumed by Reserve Banks as well as commercial banks who participate in private systems for their electronic payments. (See appendix 1 for a description of that policy.)

Federal Reserve Daylight Overdraft Risk and the Operation of Fedwire

While various types of transactions affect the reserve balances of banks, daylight overdrafts generally reflect large transactions through Fedwire, the wire transfer system operated by the Federal Reserve System. Institutions with reserve or clearing accounts at a Reserve Bank may transfer their reserve balances to other institutions that have similar accounts. These transfers, which averaged $605 billion per business day in 1987, are processed electronically through Fedwire.

Federal Reserve Banks transfer reserves to receiving banks even if the reserve balance of the sending bank is insufficient to cover the transfers. Transfers over Fedwire are "final" when the receiving banks are notified of the transfers. Thus, if a sending bank should fail while its reserve account was overdrawn, the Federal Reserve would have no claim on banks that received reserves from the failed bank over Fedwire.

U.S. Treasury and agency securities also are transferred among banks over Fedwire. Ownership

records of these securities are maintained in each Federal Reserve Bank's computer system. Banks can transfer securities held in their names to other institutions through these computers, a system called "book-entry." A transfer of securities in book-entry form can be arranged either in conjunction with a transfer of reserves of equal value or as a separate transaction. Such securities transactions contribute to daylight overdrafts, since typically the reserve accounts of banks are debited when their book-entry securities accounts are credited. Transfers of book-entry securities over Fedwire averaged $312 billion per day in 1987.

The Federal Reserve measures its exposure to payments system risk by simply summing the maximum daylight overdraft each day across all banks. In 1987, the Fed's exposure to daylight overdrafts averaged $112 billion, approximately 53 percent of which can be attributed to transactions involving book-entry government securities.[1] Some specific features of this risk measure should be noted. First, unlike conventional risk measures, the Federal Reserve's measure does not incorporate the probability that a bank will fail while in an overdraft position or the probability of Fed losses in such situations.[2] Since the Federal Reserve has never incurred a loss on daylight overdrafts, the probability of losses in the future are quite low.

Second, it exceeds the actual sum of reserve account overdrafts at any point during the day; the maximum overdrafts of individual banks typically occur at different times during the day. Third, it represents the loss that the Federal Reserve would incur on a given day if all banks with overdrawn reserve accounts failed when their overdrafts were at maximum levels and the Federal Reserve recovered nothing.

Systemic Risk and the Operation of CHIPS

The Clearing House Interbank Payments System (CHIPS) is an electronic payment system operated by the New York Clearing House. It currently is the only private electronic payment system in operation in the United States. CHIPS has about 140 members, which include U.S.-chartered banks and foreign banks. Members of CHIPS send and receive payment messages during the day; no funds are actually transferred to cover these payment messages, however, until the end of the day. Net obligations are settled at day's end through Fedwire transfers in the reserve accounts of CHIPS participants. Banks in net debit positions on CHIPS at the end of the day (value of payment messages sent exceeds the value of payment messages received) transfer funds from their accounts at Reserve Banks to a reserve account maintained by the clearing house at the Federal Reserve Bank of New York, while banks in net credit positions receive reserve transfers from that account. The value of payment messages processed by CHIPS averaged $555 billion per day in 1987.

Systemic risk refers to the risk that the failure of one bank will cause one or more other banks to fail. One way that this could happen is through participation in CHIPS. If a bank fails while in a net debit position on CHIPS, other CHIPS participants could suffer losses as well, depending on the procedures in force for dealing with such a default. Payments over Fedwire, in contrast, involve no systemic risk. The Federal Reserve would absorb any losses resulting from failures by banks with overdrawn reserve accounts.

The Federal Reserve measures the payments system risk assumed by CHIPS participants as the sum of their *maximum* net debit positions during the day on CHIPS. This measure averaged $43.7 billion in 1987.

To relate this measure to systemic risk is difficult, however; under current CHIPS rules, payment messages do not reflect intraday extensions of credit among banks but provisional payments which may be unwound at the end of the day. If a bank could not cover its net debit position on CHIPS at the end of the day, all payment messages to and from that bank would be canceled; new net debit and credit positions would then be calculated for the remaining CHIPS participants, and payments would be made to cover these revised positions. Unwinding CHIPS payments because of a defaulting bank, however, could expose the remaining CHIPS participants to losses if their de-

[1]Daylight overdrafts attributed to transactions in book-entry securities are calculated as follows. A bank is in a net credit position on book-entry securities transfers if the value of securities transferred to the bank's book-entry securities account exceeds the value of securities transferred out of that account to other banks. The book-entry overdraft of a bank for each day equals its largest net credit position on securities transfers that occurs while the reserve account of the bank is overdrawn.

[2]In conventional definitions, risk is specified in terms of the probability distribution of returns on an investment. Under one definition, risk may be measured as the variance of the distribution of returns. See Rothschild and Stiglitz (1970).

positors had withdrawn balances credited to their accounts during the day based on payment messages from the defaulting bank. These banks in turn may be unable to recover the funds withdrawn by their depositors during the day.[3]

Federal Reserve Policy on Payments System Risk

In recent years, the Federal Reserve Board has taken actions to limit its own risk and the systemic risk involved in CHIPS. The Federal Reserve induced CHIPS to require each bank in its system to establish bilateral net debit limits with each other CHIPS participant, beginning in 1984. Under another program that went into effect in March 1986, the Federal Reserve requires banks to set limits on their daylight overdrafts across Fedwire and CHIPS. (See appendix 1 for details of these policies.) The Fed is currently studying proposals to establish an explicit or implicit price for daylight overdrafts of reserve accounts.

HOW PAYMENTS AFFECT RISK

This section uses simple balance sheets of hypothetical banks to illustrate how transactions through the payments system affect the exposure of the Federal Reserve and commercial banks to potential losses. The illustrations involve federal funds transactions and transactions among CHIPS participants. Appendix 2 illustrates how the payment practices of banks that serve government securities dealers and those that issue and redeem commercial paper affect their reserve overdrafts.

Federal Funds Transactions

Banks that borrow federal funds overnight are concerned primarily about their reserve balances as of the end of the day, rather than during the day, for two reasons. First, the Federal Reserve is more tolerant of daylight overdrafts of reserve accounts than of negative reserve balances at the close of business. Second, the intraday reserve balances do not count toward meeting reserve requirements; only those balances held at the end of the business day do.

Banks that borrow overnight federal funds typically receive reserves from the lending banks over Fedwire late in the day; they return the requisite reserve balances the following morning. Such transfers can cause the borrowing banks to overdraw their reserve balances during the day.

The balance sheet entries in table 1 illustrate how federal funds transactions affect the risk borne by the Federal Reserve. Each bank begins the day with deposits of $100 and reserves of $10. With a 10 percent reserve ratio, excess reserves are zero. During the previous business day, Bank A borrowed $25 from Bank B through the federal funds market. Before the end of business on the previous day, Bank B transferred $25 over Fedwire from its reserve account to the account of Bank A. This transaction created a liability for Bank A (federal funds purchased) and shifted $25 of the assets of Bank B from reserve balances to federal funds sold.

The first transaction by Bank A in the current day is a transfer of $25 from its reserve account to the reserve account of Bank B, returning the funds it had borrowed overnight; this eliminates the liability of federal funds purchased by Bank A. Since the balance in the reserve account of Bank A was only $10 at the start of the day, the transfer of $25 makes its reserve account overdrawn by $15. This presents no problem for Bank A, however, since it plans to borrow $25 through the federal funds market later in the day to eliminate its reserve overdraft and meet its reserve requirement of $10.

If Bank A borrows the $25 in the federal funds market, the lending bank(s) will transfer the reserves to the account of Bank A in the afternoon. Given the time gap between the transfer of funds to lending banks in the morning and the transfer of reserves to Bank A in the afternoon, the Federal Reserve effectively lends $15 to Bank A during part of the business day by permitting the reserve overdraft.

The Fed is a general creditor of Bank A while its reserve account is overdrawn. To illustrate the risk it assumes in permitting daylight overdrafts, suppose that participants in the federal funds market find out that the value of Bank A's assets have declined by $15 just after Bank A transfers $25 to Bank B. After this information becomes known, Bank A will be unable to borrow reserves in the federal funds market at prevailing market rates. The agency that chartered Bank A must decide whether it is solvent. If Bank A is declared solvent and has assets to pledge as collateral, it could

[3]The legal status of claims by the banks against their depositors in such situations is currently unclear. See Mengle (1989).

Table 1

Risk Created by the Transfer of Reserve Balances in Overnight Federal Funds Transactions

Balance sheets at start of day:

Bank A				Bank B			
Reserves	$ 10	Deposits	$100	Reserves	$ 10	Deposits	$100
Other assets	125	Federal funds purchased	25	Federal funds sold	25	Net worth	10
		Net worth	10	Other assets	75		

Bank A sends $25 of its reserve balances to Bank B over Fedwire:

Bank A				Bank B			
Reserves	– $ 15	Deposits	$100	Reserves	$ 35	Deposits	$100
Other assets	125	Federal funds purchased	0	Federal funds sold	0	Net worth	10
		Net worth	10	Other assets	75		

Value of other assets at Bank A reduced by $15:

Bank A				Bank B			
Reserves	– $ 15	Deposits	$100	Reserves	$ 35	Deposits	$100
Other assets	110	Federal funds purchased	0	Federal funds sold	0	Net worth	10
		Net worth	– 5	Other assets	75		

receive a loan from the Federal Reserve to cover its reserve overdraft. If the supervisory agency declares Bank A insolvent, it will be closed. If Bank A is closed and liquidated, the depositors get first claim on the $110 of "other assets." In this case, the Federal Reserve will receive $10 against the $15 overdraft of the reserve account and, thus, will lose $5.

If the Federal Reserve had known that Bank A was in poor financial condition, it would have required the bank to pledge collateral against its overdrafts.[4] By requiring collateral, the Fed shifts the risk to other parties. Suppose, in this case, that Bank A had pledged $15 of its riskless assets to the Federal Reserve to cover its overdrafts. When the bank fails, the Fed would hold the $15 in collateral to cover any losses. The loss of $5 would be borne by uninsured depositors or the Federal Deposit Insurance Corporation (FDIC). Thus, requiring collateral against reserve overdrafts does not necessarily protect the public sector; it may simply shift the loss from the Federal Reserve to the FDIC.

Transactions Among CHIPS Participants

In the case illustrated in table 1, the Federal Reserve assumes the risk. Banks also assume risk by participating in CHIPS. The interbank risk exposures created through the processing of payment messages through CHIPS are illustrated in table 2.

In the first transaction of the day, a depositor of Bank A sends $25 to a depositor of Bank B in the

[4]Task Force (1988), pp. 65–69.

Table 2
Risk Created by the Transfer of Funds over CHIPS

Balance sheets at start of day:

Bank A				Bank B			
Reserves	$ 10	Deposits	$100	Reserves	$ 10	Deposits	$100
Other assets	100	Net worth	10	Other assets	100	Net worth	10

Depositor at Bank A transfers $25 to depositor of Bank B, transaction over CHIPS:

Bank A				Bank B			
Reserves	$ 10	Deposits	$ 75	Reserves	$ 10	Deposits	$125
Other assets	100	Reserves payable	25	Reserves receivable	25	Net worth	10
		Net worth	10	Other assets	100		

Depositor at Bank B transfers $25 to depositor of Bank C, over CHIPS:

Bank B				Bank C			
Reserves	$ 10	Deposits	$100	Reserves	$ 10	Deposits	$125
Reserves receivable	25	Reserves payable	25	Reserves receivable	25	Net worth	10
Other assets	100	Net worth	10	Other assets	100		

form of a wire transfer over CHIPS. Bank A debits the deposit account of that customer for $25. Because banks do not report their balance sheets on an intraday basis, there is no official term for the offsetting liability entry in this transaction. In this case, we will call it "reserves payable." For Bank B, deposit liabilities and an asset item called "reserves receivable" each increase by $25.

In the next transaction, a depositor of Bank B directs it to send $25 to a customer of Bank C. After the second transaction, Bank B is even with CHIPS. If there were no more transactions over CHIPS that day involving Bank B, the settlement for CHIPS transactions would have a zero impact on the reserve account of Bank B. Bank A, in contrast, would have its reserve account debited for $25, while Bank C would have its account credited by $25. Bank A would have to increase its reserve balance before the time for settlement of CHIPS payments to facilitate settlement.

Suppose that, before the end of the day, adverse publicity prevents Bank A from borrowing $25 in the federal funds market. This situation could create a liquidity problem for Bank B. If Bank A cannot obtain sufficient reserves to cover its net debit position on CHIPS, current rules call for unwinding all transactions involving Bank A and settling the transactions among the remaining CHIPS participants. This settlement would involve a transfer of $25 in reserves from Bank B to Bank C. Such a net settlement cannot take place, however, because Bank B has only $10 in its reserve account. Thus, unless the Federal Reserve lends $25 to Bank A or Bank B, all CHIPS transactions for the day would be canceled.

Simulation exercises indicate that the unwinding of transactions with one large CHIPS participant that cannot meet its payment obligations would make a high percentage of other participants unable to meet their commitments on

CHIPS without additional reserves.[5] In these exercises, some banks that become illiquid have no direct transactions with the defaulting bank. Thus, as illustrated in table 2, a default by Bank A keeps Bank C from receiving its payments over CHIPS, because the default by Bank A makes Bank B illiquid.

As the central bank, the Federal Reserve is responsible for preventing such a liquidity crisis. In our example, the Fed could lend reserves either to Bank A or Bank B. If it considers Bank A to be solvent, it could lend the $25 and take collateral. The $25 added to the reserve account of Bank A facilitates the net settlement on CHIPS. If Bank A turns out to be insolvent, the collateral protects the Federal Reserve from loss, transferring it instead to the general creditors and the FDIC.

Alternatively, the Federal Reserve could prevent a liquidity crisis by lending $25 to Bank B, allowing Bank B to meet its required reserves and CHIPS obligation to Bank C. Even if the Fed prevents a liquidity crisis by lending $25 to Bank B, the default of Bank A could make Bank B insolvent. This is an example of systemic risk involved in the operation of the payments system. Suppose that the transfer of $25 from Bank B to Bank C is initiated by the depositor of Bank B who received $25 from Bank A. Bank B makes this transfer before discovering the default by Bank A. At this time, it is not clear whether the courts would permit Bank B to regain these funds from its depositor.[6] If Bank B's loss exceeds $10, it is bankrupt.

Suppose, instead, that this depositor of Bank B holds the extra $25 in its demand deposit account at Bank B until the end of the day. The transfer of reserves from Bank B to Bank C was initiated by a different depositor of Bank B. When Bank A's default is discovered, Bank B could cancel the $25 in reserves receivable and reverse the $25 credit to its demand deposit liabilities. In this case, the unwinding of the CHIPS transaction has no adverse effect on the net worth of Bank B.

THE EFFECTS OF POSSIBLE CHANGES IN POLICY

Changes in policy on payments system risk are being discussed within the Federal Reserve System and the private sector. This section illustrates the effects of two possible policy changes: explicit fees on reserve account overdrafts and interest-earning reserve balances required to cover part or all of daylight overdrafts.[7]

Federal Reserve policymakers have indicated that such changes would be adopted only after CHIPS has developed arrangements for ensuring the execution of payments on that system that they consider acceptable.[8] This section also illustrates the implications of such an arrangement for banks.

Explicit Pricing of Daylight Overdrafts of Reserve Accounts

One way to reduce Federal Reserve risk would be to charge a fee on daylight overdrafts. If the fee were high enough, banks would reduce the size of their overdrafts by changing their practices for making payments.

Responses of Banks to Pricing Daylight Overdrafts — Perhaps the easiest and least expensive change for most of the relatively large banks would involve routing more of their wire transfers of funds through CHIPS rather than Fedwire. There are other ways for banks to reduce their reserve account overdrafts. They could purchase more of their federal funds as term federal funds or under rollover arrangements that involve paying a daily rate but eliminating the daily transfer of reserve balances. Pricing total daylight overdrafts of reserve balances (including book-entry overdrafts) would impose costs on the clearing banks, which they would pass on to the government securities dealers they serve. The dealers could reduce book-entry daylight overdrafts by building smaller inventories of securities during the day or holding larger inventories overnight. Banks that act as agents in issuing commercial paper could charge

[5]Humphrey (1986).

[6]Mengle (1989).

[7]For discussions of these possible changes from Federal Reserve sources, see Belton, et al. (1987), Corrigan (1987), Johnson (1988), Task Force (1988) and Mengle, et al. (1987). For discussions of these issues by those in the private sector, see Flannery (1987), Faulhaber, et al. (1989) and Large Dollar Payments System Advisory Group (1988). Governor Wayne D. Angell of the Federal Reserve Board has proposed another approach to revising policy on payments system risk. Under the Angell proposal, the Federal Reserve would prohibit daylight overdrafts. Transfers of reserves that would make the reserve balance of a bank negative would be funded as discount window loans. To provide banks incentives to hold enough reserves to prevent overdrafts, the Federal Reserve would pay interest on excess reserves, but at a rate below the discount rate. See VanHoose (1988).

[8]Johnson (1988), p. 15.

issuers for the fees on overdrafts or delay payments to issuers until they receive payments from purchasers.

Effects in Financial Markets — Pricing daylight overdrafts could have a variety of indirect effects in the financial markets. Banks that lend in the overnight federal funds market could find that their reserves are being returned later the following day. The time value of intraday reserves might lead to the development of an intraday federal funds market, with lenders making reserve balances available to borrowers for only part of the business day. Some analysts think this could lead to greater variability in an overnight federal funds rate and other interest rates.[9]

Banks could limit the size of their daylight overdrafts by delaying wire transfers of funds for depositors that do not demand immediate delivery of funds; or, they might charge an extra fee to depositors that demand immediate delivery.

Clearing banks would charge government securities dealers for the cost of the fee on daylight overdrafts. Government securities dealers, in turn, would increase the transaction costs of buying and selling government securities. Interest rates on government securities would rise somewhat relative to yields on alternative investments, increasing the Treasury's cost of servicing the national debt.

How banks react to daylight overdraft fees could affect market yields on other financial instruments. For instance, the fee on overdrafts would increase the costs to banks acting as agents for firms that issue commercial paper. The responses by the agent banks could increase the costs to firms of raising funds by issuing commercial paper.[10]

Supplemental Balance Requirement

The Federal Reserve could impose an implicit price on daylight overdrafts by requiring the banks that overdraw their reserve accounts to hold supplemental reserve balances. These requirements would be set to cover part or all of their daylight overdrafts. The suggested interest rate to be paid on the supplemental balances would be slightly below the federal funds rate, thus creating an opportunity cost of holding supplemental reserves. This cost would have the same implications for bank behavior and financial markets as an equal explicit fee on daylight overdrafts.

The implications of a supplemental reserve requirement can be examined by adjusting the balance sheet entries in table 1. In this case, Bank A would be required to increase its average end-of-day reserve balance by $15. A reserve balance of $25 at the start of the day would eliminate the risk of Federal Reserve loss because Bank A's reserve balance would not fall below zero after the $25 transfer.

The method by which Bank A raises the $15 supplemental balance affects the distribution of potential losses among participants in the banking industry. Suppose, for example, Bank A sold some assets to obtain the $15 in additional reserves. This response would raise the risk-adjusted capital ratio of Bank A, unless it shifted the remaining $110 of other assets into categories with higher risk weights. A rise in Bank A's risk-adjusted capital ratio would reduce the FDIC's potential losses.[11]

Suppose, instead, that Bank A raises the $15 in supplemental reserves by increasing federally insured deposits from $100 to $115. This response would increase the potential losses faced by the FDIC.[12]

Bank A also could raise the additional $15 in the term federal funds market. The claims of those selling term federal funds to Bank A would be subordinate to the claims of Bank A's depositors. Thus, the supplemental balance requirement would shift risk to those banks supplying the term

---

[9]Task Force (1988), pp. 103–14.

[10]To illustrate the potential effects on the cost of issuing commercial paper, suppose the Federal Reserve charges 100 basis points at an annual rate on the maximum daylight overdraft of each bank. See Mengle, et al. (1987) for the basis for such a rate. If an agent bank continues the timing of payments described in appendix 2 in issuing and redeeming commercial paper, the overdrafts fee would cost $54.79 per $1 million of commercial paper issued and redeemed. If the banks pass this cost on to the issuers, the annual cost of raising funds by issuing commercial paper every 30 days would rise by 7 basis points.

[11]A risk-based capital ratio is calculated as a measure of capital divided by weighted assets, with weights assigned as approximations to relative risk. Reserves have a weight of zero. See "Proposals for International Convergence" (1988).

[12]Assume that these additional federally insured deposits have a zero reserve requirement. To illustrate the implications for FDIC risk, suppose that after Bank A transfers $25 to Bank B, there is a public announcement of events that reduce the value of the assets of Bank A by $15. Bank A fails and the FDIC becomes the receiver. As receiver, the FDIC obtains assets worth $110 and assumes liabilities of $115, for a net loss of $5. In this case, therefore, the supplemental balance requirement shifts risk from the Federal Reserve to the FDIC.

federal funds, increasing the systemic risk in the banking system.

Of course, supplemental balance requirements also would give banks an incentive to reduce the size of the intraday movements in their reserve balances, since the interest rate paid on the balances would be below the marginal return on other assets and below the interest rate on federal funds. The supplemental balance requirement would be reduced to the extent that a bank kept its reserve balance positive throughout the business day. Suppose, for instance, that Bank A changes its intraday pattern of payments so that, with the supplemental requirement of $15, its reserve balance never falls below $5. The Federal Reserve might reduce its supplemental balance requirement to $10, thus reducing the opportunity cost of Bank A.

Provisions for Settlement Finality of Payments over CHIPS

Settlement finality would involve procedures for ensuring the execution of payments (avoid unwinding payments involving a defaulting bank) and the allocation of losses in the event of a default by a CHIPS participant.[13] If losses are spread widely among CHIPS participants, the failure of a CHIPS participant to meet its payment obligation would probably not cause other banks to fail.

The implications of settlement finality arrangements for payments system risk are illustrated using the balance sheet entries in table 2. In this illustration, CHIPS is presumed to have formed a bankers' bank, which is a cooperative venture that performs banking services for CHIPS members. This institution processes payment messages for its members as debit and credit entries to their demand deposit accounts at the bankers' bank.[14] The illustration is based on some general principles of settlement finality arrangements that have been considered for several years.[15]

The hypothetical arrangement requires members of CHIPS as a group to pledge enough collateral with their bankers' bank to cover the largest net debit position of any one participant. This is based on the idea that a default by one large participant would disrupt the operation of CHIPS. Since there has never been a default by a CHIPS participant, however, a default by one large participant is an unlikely event. Collateral requirements for CHIPS participants in excess of the largest net debit of an individual CHIPS participant could be interpreted as an excessive degree of precaution.

In table 2, the largest net debit position is $25. To cover this position (and to allow some margin for error), CHIPS requires each of the three banks to pledge $10 of their interest-earning assets with CHIPS in the form of Treasury securities.

Suppose that after CHIPS processes the transactions described in table 2, an announcement indicates a $15 loss in the value of Bank A's assets. Under the settlement finality arrangement, CHIPS would use the collateral posted by its participants to raise $25, either by selling part of the collateral

---

[13]Discussions of the finality of payments on private wire transfer systems mention three aspects of finality. Sender finality makes each message over the payments system final when sent. Payment messages cannot be canceled later in the day. The rules for payment messages on CHIPS include sender finality.

Settlement finality refers to procedures that would ensure the settlement of payments if a participant defaults on its net debit at the end of the day. CHIPS does not have settlement finality procedures in place at this time. Under current procedures, CHIPS would cancel all payments by the bank that defaults, as well as all payments to that bank, and calculate new net debit or credit positions for the remaining participants. This section illustrates the implications of adopting a form of settlement finality.

Under receiver finality, credits to the deposit accounts of the customers of CHIPS participants would be final when the receiving banks receive payments messages over CHIPS. If a sending bank defaults, the receiving bank would have no recourse to its depositors. CHIPS rules do not include receiver finality. For additional discussion of these aspects of the finality of payments, see Humphrey (1986) and Belton, et al. (1987).

[14]CHIPS has considered developing a bankers' bank to ensure that payment obligations over CHIPS would be treated as net rather than gross obligations in the case of a default by a CHIPS participant. See Kantrow (1988). To illustrate the significance of the distinction between gross and net obligations, suppose a bank fails while it is in a net credit position on CHIPS payments. If CHIPS obligations are treated legally as net obligations, CHIPS participants would make a payment to the receiver of the failed bank for the amount of the net debit position. The receiver of the failed bank might sue CHIPS participants based on gross obligations. Under a successful suit by the receiver, those that had sent payment messages to the failed bank would have to pay the gross amount of those payments, and those who received payment messages from the failed bank would become its general creditors for the amount of the gross transfers from the failed bank. This treatment of CHIPS participants would increase the recovery rate of the failed bank's other general creditors. There have been no such cases to indicate whether the courts would uphold payments to the receiver based on gross payments.

Suppose, in contrast, that CHIPS payments are processed through demand deposit accounts at the bankers' bank for CHIPS. Under that arrangement, the only claim of the receiver of the failed bank would be for the positive balance of the failed bank in its demand deposit account at the bankers' bank.

[15]Mengle (1989).

or using the securities as collateral for a loan at the Federal Reserve discount window. CHIPS would then transfer the $25 to the reserve account of Bank B, facilitating the payment from Bank B to Bank C. In turn, the bankers' bank of CHIPS would hold the $10 in collateral posted by Bank A and have a $15 claim against Bank A as a general creditor. Losses on the $15 claim against Bank A would thus be spread between Bank B and Bank C. Neither bank would be forced into bankruptcy by a complete loss on the $15 claim.

From the Federal Reserve's perspective, this settlement finality arrangement is better than the procedure that currently would be used to deal with a default by a CHIPS participant — unwinding payments involving the bank. If this settlement finality arrangement were in place, the unwinding of payments, which would disrupt the flow of payments in the economy, could be avoided. If a discount window loan was necessary to avoid a liquidity crisis in the banking system, the collateral would be available through the CHIPS organization. The Federal Reserve would not have to decide which banks should receive discount window loans.

By making the risk to CHIPS participants more explicit, the arrangement would give CHIPS participants stronger incentives to exclude banks in relatively poor financial condition from their system. Banks that are excluded would route their wire transfers through Fedwire, thus reducing systemic risk. Finally, the spreading of potential losses would limit the chances of the failure of one bank causing others to fail. It is not possible to determine whether the risk of bank failure is lower under current CHIPS procedures or under this proposed procedure for settlement finality. Such a comparison depends on the extent to which depositors of CHIPS participants draw down the intraday credits to their demand deposit accounts and the success that banks would have in collecting from those depositors in case of a default by a CHIPS participant.

CONCLUSIONS

All banks assume some risk by participating in the payments system. The payment practices that generate this risk were developed in an environment in which there was no interest charge on intraday credit and, until recently, no constraints on the magnitude of intraday credit. There have been no losses to the Federal Reserve or to members of private wire transfer systems resulting from the daylight credit exposures. The Federal Reserve, however, has adopted a policy on payments system risk which includes limits on the daylight overdrafts of individual banks.

The Fed has been considering possible changes in its policy to reduce its own risk and provide incentives for banks to change the payment practices that tend to create the intraday risk exposures. One proposed approach involves a fee on daylight overdrafts of reserve accounts. A second approach, which involves an implicit price on daylight overdrafts, requires additional reserve balances at the banks which regularly overdraw their reserve accounts during the day. The Federal Reserve would pay interest on these supplemental reserve balances at a rate just below the federal funds rate. Under either approach, CHIPS would be required to work out an arrangement that is satisfactory to the Federal Reserve to ensure the finality of its payments.

The objective of changing the policy on payments system risk is to reduce the risk of the Federal Reserve without creating a large increase in systemic risk — the risk that the failure of one bank will cause the failure of other banks, thus disrupting the operation of the payments system. The type of settlement finality arrangement desired by the Federal Reserve would ensure the execution of payments over CHIPS in the event of a default by a CHIPS participant and spread any losses so widely among other CHIPS participants that one bank failure is unlikely to lead to the failure of other CHIPS participants.

REFERENCES

Association of Reserve City Bankers. *Report of the Working Group of the Association of Reserve City Bankers on Book-Entry Daylight Overdrafts* (June 1986).

Belton, Terrence M., et al. "Daylight Overdrafts and Payments System Risk," *Federal Reserve Bulletin* (November 1987), pp. 839–52.

Corrigan, E. Gerald. *Financial Market Structure: A Longer View* (Federal Reserve Bank of New York, January 1987).

Faulhaber, Gerald R., Almarin Phillips, and Anthony M. Santomero. "Payment Risk, Network Risk and the Role of the Fed," in David B. Humphrey, ed., *U.S. Payment System: Efficiency, Risk and the Role of the Federal Reserve System* (Kluwer, 1989).

Flannery, Mark J. "Payments System Risk and Public Policy," Mimeo, University of North Carolina at Chapel Hill, November 30, 1987.

Humphrey, David B. "Payments Finality and Risk of Settlement Failure," in Anthony Saunders and Lawrence J. White, ed., *Technology and the Regulation of Financial Markets* (Lexington Books, 1986).

Johnson, Manuel H. "Challenges to the Federal Reserve in the Payments Mechanism," *Issues in Bank Regulation* (Summer 1988), pp. 13–16.

Kantrow, Yvette D. "Big NY Banks May Spin Off Chips Network," *American Banker* (June 27, 1988), pp. 1, 23.

Large-Dollar Payments System Advisory Group. *A Strategic Plan for Managing Risk in the Payments System*, Report to the Payments System Policy Committee of the Federal Reserve System, Board of Governors of the Federal Reserve System, August 1988.

Mengle, David L. "Legal and Regulatory Reform in Electronic Payments: An Evaluation of Finality of Payment Rules," in David B. Humphrey, ed., *U.S. Payment System: Efficiency, Risk and the Role of the Federal Reserve System* (Kluwer, 1989).

Mengle, David L., David B. Humphrey, and Bruce J. Summers. "Intraday Credit: Risk, Value and Pricing," Federal Reserve Bank of Richmond *Economic Review* (January/February 1987), pp. 3–14.

"Proposals for International Convergence of Capital Measurement and Capital Standards." *Issues in Bank Regulation* (Winter 1988), pp. 3–12.

Rothschild, Michael, and Joseph E. Stiglitz. "Increasing Risk: I. A Definition," *Journal of Economic Theory* (September 1970), pp. 225–43.

Task Force on Controlling Payments System Risk. *Controlling Risk in the Payments System*, Report to the Payments System Policy Committee of the Federal Reserve System, Board of Governors of the Federal Reserve System, August 1988.

VanHoose, David. "The Angell Proposal: An Overview," staff paper, Board of Governors of the Federal Reserve System (June 1988).

Appendix 1
Current Federal Reserve Policy on Payments System Risk

Currently, the Federal Reserve uses specific limits on daylight overdrafts of reserve accounts and net debit positions on private wire transfer systems to reduce payments system risk. The limits on net debit positions apply to any private wire transfer system that settles the net positions of its participants through transfers of balances in reserve or clearing accounts at Reserve Banks. Since CHIPS is the only such system in operation, the following description refers only to it, but would apply to any such system developed in the future.[1]

Bilateral Net Credit Limits on CHIPS

The Federal Reserve requires each participant on CHIPS to set a limit on its net credit position on message transfers with each of the other participants in the system. Funds transfer messages that violate these bilateral net credit limits are rejected by the computer system that processes payment messages. CHIPS participants have had bilateral credit limits since October 1984.

Sender Net Debit Caps on CHIPS

The Federal Reserve requires CHIPS to establish limits on the net debit positions of each participant with all other participants on the system. CHIPS sets this limit for each participant at 5 percent of the sum of all bilateral credit limits for that participant extended by all other CHIPS participants.[2] CHIPS established these sender net debit caps in October 1985.

Cross-System Caps

Each bank that occasionally has daylight reserve overdrafts is required to adopt a cap on its cross-system daylight overdraft. Cross-system refers to the daylight overdraft position on Fedwire and CHIPS. The relevant overdraft position for this cap is the sum of a bank's funds-related overdraft of its reserve account and its net debit position on CHIPS at each moment during the day. Each bank sets its cap by placing itself in one of the possible categories indicated in table A1; banks are directed to consider their creditworthiness, credit policies and operational control and procedures. Each possible rating has corresponding caps for both the one day and two-week average maximum daylight overdraft, each as a percentage of primary adjusted capital. These percentages have been

[1]For an analysis of the effects of these credit limits on daylight overdrafts and the operation of the payments system, see Belton, et al. (1987).

[2]There are additional details involved in determining these limits. See Belton, et al. (1987).

Table A1

Caps on Daylight Overdrafts Across Payments Systems (multiples of adjusted primary capital)

Self-assessment category	Cap applied to	Period caps in effect: March 27, 1986 to January 13, 1988	January 14, 1988 to May 18, 1988	May 19, 1988 to present
High	Two-week average	2.000	1.700	1.500
	Single day	3.000	2.550	2.250
Above average	Two-week average	1.500	1.275	1.125
	Single day	2.500	2.125	1.875
Average	Two-week average	1.000	0.850	0.750
	Single day	1.500	1.275	1.125
Limited	Two-week average	0.500	0.425	0.375
	Single day	0.500	0.425	0.375

NOTE: Adjusted primary capital for U.S.-chartered banks is the sum of primary capital less all intangible assets and deferred net losses on loans and other assets sold.
SOURCE: Federal Reserve Bulletin (November 1987), p. 843.

reduced over time to make them more effective in constraining overdrafts.

Book-Entry Securities Transfers

In calculating the relevant measure of overdrafts for the cross-system caps, the Federal Reserve nets out the value of book-entry securities credited to the account of the bank. This step exempts daylight overdrafts generated through securities transactions from the limits imposed by the caps. The Federal Reserve has allowed this distinction to avoid disrupting the market for U.S. government securities.

Appendix 2
Additional Illustrations of Payments and Risk

Transfers for Depositors Over Fedwire

Wire transfers of funds for depositors may cause banks to overdraw their reserve accounts, as table A2 illustrates. A depositor instructs Bank A to pay $25 to a depositor of Bank B in the form of a wire transfer. Since the initial reserve balance is only $10, the $25 transfer makes the reserve account of Bank A overdrawn by $15. As in table 1 in the text, an announcement of a $15 decline in the value of the assets of Bank A would force the Federal Reserve to absorb a $5 loss.

Table A2
Risk Created by Transferring Depositor's Funds over Fedwire

Balance sheets at start of day:

Bank A				Bank B			
Reserves	$ 10	Deposits	$100	Reserves	$ 10	Deposits	$100
Other assets	100	Net worth	10	Other assets	100	Net worth	10

Bank A sends $25 of depositor's money to Bank B over Fedwire:

Bank A				Bank B			
Reserves	−$ 15	Deposits	$ 75	Reserves	$ 35	Deposits	$125
Other assets	100	Net worth	10	Other assets	100	Net worth	10

Value of other assets at Bank A reduced by $15:

Bank A				Bank B			
Reserves	−$ 15	Deposits	$ 75	Reserves	$ 35	Deposits	$125
Other assets	85	Net worth	−5	Other assets	100	Net worth	10

Securities Transfers

A few banks incur large daylight overdrafts because of the transactions they conduct for customers that deal in U.S. government securities. These transactions warrant special examination. A few large banks (called clearing banks) specialize in serving government securities dealers; these banks generate a large share of the total daylight overdrafts of bank reserve accounts. In the second quarter of 1988, for example, four clearing banks accounted for about 70 percent of the daylight overdrafts attributable to transactions in book-entry securities.

Business Practices of Dealers and Clearing Banks — Government securities dealers who buy and sell securities for their customers have no direct access to the book-entry system for transferring ownership of government securities. Instead, they maintain book-entry securities accounts and demand deposit accounts with commercial banks that serve as their clearing banks for securities transfers.

Daylight overdrafts of the clearing banks' reserve accounts reflect the practices of the government securities dealers in managing their inventories of governments securities. Dealers hold large inventories of securities during the day to meet the anticipated demands of their customers. To minimize the cost of holding the inventories, the dealers sell most of their securities by the end of the day through repurchase agreements. The investors who enter into these agreements "own" the securities overnight and "resell" them to dealers early the next day. Thus, the dealers build their inventories of government securities in the morning of each business day by receiving securities returned by the overnight repo investors and buying additional securities offered for sale.[1]

The following features of the business practices of government securities dealers explain why they generally wait until early afternoon to begin run-

[1]For a more complete discussion of the practices of clearing banks and dealers, see Association of Reserve City Bankers (1986).

ning down their inventory of securities. Salesmen for a dealer make commitments to deliver specific securities to its customers by the end of the day. The dealer is then vulnerable to losses if it cannot fulfill these commitments. The customers receive interest on the promised securities for that day, even if the dealer does not make delivery. The customers, however, make payments to the dealers only when the securities are delivered. The dealer would fail to make delivery if it could not locate the desired securities in its inventory or in the market, or if it sent the wrong securities to a customer and had them returned. Each dealer attempts to minimize the probability of such "fails" by waiting until early afternoon to direct its clearing bank to send its securities to the book-entry accounts of the banks that serve the customers that have bought them.

Another reason the dealers hold their securities until early afternoon involves potential profits from special orders. On some days, certain issues of government securities are in relatively high demand. The dealers can make larger profits if they have securities available to meet these special orders. In contrast to the specific requirements for special orders, dealers may substitute a wide variety of securities as acceptable collateral for repos.

Effects on Intraday Reserve Balances — These dealer practices affect the intraday patterns of their demand deposit balances and the reserve balances of the clearing banks that serve them. When a repo investor returns the securities to the dealer, there is an increase in the securities account of the dealer at its clearing bank and an equal reduction in its demand deposit account. On the books of the Federal Reserve, there is an increase in the securities in the book-entry account of the clearing bank and a reduction in the reserve account of the clearing bank. The same transactions occur when the dealer buys securities to hold in its inventory that day. The dealer builds its inventory of securities by overdrawing its demand deposit account during the day. The dealers do not control the timing of these inflows of securities to their accounts and the outflows from their demand deposit accounts, since the party that holds the securities initiates the transfer of securities and reserves through the Fedwire system.

The process of overdrawing reserve and deposit accounts is reversed later in the day as the dealers sell their inventories of securities. The reserve accounts of the clearing banks rise as the book-entry securities are transferred to the accounts of other banks and reserve balances are simultaneously transferred to the accounts of the clearing banks. The timing of transactions in book-entry securities for the dealers causes the reserve accounts of the clearing banks to be overdrawn by billions of dollars during part of the day.

Implications for Risk— The clearing banks extend credit to government securities dealers during the day by allowing them to overdraw their demand deposit accounts. The banks limit their risk by obtaining a lien against the securities held for the account of the dealers. Thus, a clearing bank could claim the securities credited to the account of a dealer to cover any losses on its deposit overdraft.[2]

The Federal Reserve has considered various methods of establishing liens against the securities in the book-entry accounts of banks but has not initiated such collateral arrangements. Thus, the Fed is vulnerable to losses on the full amount of a bank's reserve overdraft, whether the overdraft was generated through funds transfers or transactions in book-entry securities.[3]

The risk implications of book-entry overdrafts can be illustrated by examining the balance sheet entries in table A2. Bank A is a clearing bank for a governments securities dealer. The dealer receives $25 in book-entry securities and has its demand deposit account debited by $25, leaving it overdrawn at that time. Suppose the dealer goes bankrupt after this transaction is completed. Bank A claims the $25 in securities that were credited to the securities account of the dealer to cover any possible losses on the deposit overdraft. The bank is spared any losses, and the Federal Reserve suffers no losses.

This book-entry daylight overdraft, however, does leave the Federal Reserve vulnerable to a loss on the reserve overdraft. Suppose that after the dealer receives the $25 in book-entry securities, there is an announcement that implies a $15 loss in the value of the other assets of Bank A, as in the other illustrations. Under current arrangements, the Fed has no claim on the $25 in book-entry securities that had been transferred to Bank A, to offset its $5 loss. Thus, collateral agreements between clearing banks and the dealers make Federal Reserve losses due to defaults by government securities dealers unlikely, but the daylight reserve

[2]Task Force (1988), p. 69.

[3]Task Force (1988), p. 70–72.

Table A3

The Effects of Issuing Commerical Paper on the Balance Sheet of an Agent Bank

Balance sheets at start of day:

Bank A				Bank B			
Reserves	$ 10	Deposits	$100	Reserves	$ 10	Deposits	$100
Other assets	100	Net worth	10	Other assets	100	Net worth	10

Bank A transfers $25 to Bank B, credited to the account of the firm that issues commercial paper:

Bank A				Bank B			
Reserves	$ 15	Deposits	$100	Reserves	$ 35	Deposits	$125
Reserves receivable	25			Other assets	100	Net worth	10
Other assets	100	Net worth	10				

Bank A receives $25 from purchaser of commercial paper:

Bank A				Bank B			
Reserves	$ 10	Deposits	$100	Reserves	$ 10	Deposits	$100
Reserves receivable	0			Other assets	100	Net worth	10
Other assets	100	Net worth	10				

overdrafts of the clearing banks expose the Fed to potential losses in the event of large, unanticipated declines in the value of the assets of the clearing banks themselves.

A lien by the Federal Reserve against the book-entry securities in the accounts of the clearing banks might have little practical significance in limiting Fed risk. Suppose the public learns during the day that a clearing bank may be bankrupt. Would the Federal Reserve suddenly seize the book-entry securities in the account of the clearing bank? Doing so would disrupt the business of the government securities dealers served by the clearing bank and, given the high concentration of business among clearing banks, would disrupt trading in the whole government securities market. The Fed and the other federal supervisory authorities have been reluctant to close large commercial banks because of their effects on other depository institutions and the financial markets in general. A lien on the book-entry securities of banks might make the supervisory authorities more reluctant to close a large bank that also serves as a clearing bank for government securities dealers.

Issuing and Redeeming Commercial Paper

The timing of payments by banks involved in issuing and redeeming commercial paper creates reserve overdrafts.[4] Several banks act as agents for firms that issue commercial paper. The agent banks collect funds from those purchasing the commercial paper and transfer them to the accounts of those firms issuing the paper. When the paper matures, the agent banks collect from the

[4]For a discussion of how daylight overdrafts reflect transactions in commercial paper and other financial instruments, see Large-Dollar Payments System Advisory Group (1988).

paper issuers and make payments to the holders of the paper.

When a firm issues commercial paper, the agent bank generally pays the firm before it receives payment from those buying the paper. During the period between the payment to the issuer and the receipts from the purchasers, the reserve account of the agent bank falls by the amount of the funds raised by issuing the commercial paper. The reserve balance of the agent bank also falls by the face amount of the issue when the paper matures; the agent bank generally makes payment to those holding the paper before receiving payment from the issuer.

The effects of these transactions on the balance sheet of the agent bank are illustrated in table A3. A firm raises $25 by issuing commercial paper. Bank A is the agent bank, and both the issuer and purchaser of the paper have their demand deposit accounts at Bank B. Early in the day on which the commercial paper is issued, Bank A transfers $25 to Bank B, to be credited to the demand deposit account of the issuer. After that transaction, the reserve account of Bank A is overdrawn by $15. In this example, the offsetting transaction is a $25 increase in an account called "reserves receivable." Later that day, the purchaser of the paper arranges for Bank B to send $25 to Bank A over Fedwire, eliminating the reserve overdraft by the end of the day. As in the other balance sheets, the Federal Reserve is a general creditor of Bank A while its reserve account is overdrawn.