DAYLIGHT OVERDRAFTS AND PAYMENTS SYSTEM RISKS

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The last fifteen years have seen an almost incredible increase in the speed at which funds move through the economy. Central to this change has been the continual development of electronic funds transfer (EFT) networks. Although few would deny the benefits of the increasing facility with which transactions can take place, this progress has not come without cost. Specifically, there has been increasing concern with the risk exposure faced by participants in the payments system, particularly with regard to large dollar transfers that incur overdrafts.[1] Along with this concern have come proposals to deal with this exposure.

On an average day in 1984, over $640 billion was transferred by way of EFT networks. Given the interdependence that exists between participants in these networks, it is possible that losses in the event of the sudden failure of an institution could be huge. At the same time, however, such a failure is highly unlikely, and has not in fact occurred. Thus, it is possible for reasonable men to disagree on both the magnitude of the problem created by overdrafts and what to do about them.

The object of this article is to consider, in economic terms, the nature of risks on EFT networks and the desirability of specific measures proposed to deal with these risks. With regard to the former, a simple economic framework will be developed in Section II in order to analyze risks by EFT participants. With regard to the latter, Section III will describe and evaluate the various policy alternatives that have been advanced. The following questions will be implicit in the discussion of risk reduction measures:

- How will a risk reduction policy affect risk assignment?
- What incentives will the policy create among participants?
- Are the incentives created by the risk assignments likely to accomplish the policy's objective of reducing excessive risk taking ?

Particular attention will be given to pricing as a risk reduction policy and to the importance of the lender of last resort to the problem of risk on private networks. This discussion will be followed by a description of policies adopted by the Board of Governors in May 1985.

Since EFT systems are complex entities that are little known outside the banking industry, Section I will describe the major wholesale EFT networks and explain the nature of the overdraft problem. Readers who are familiar with EFT systems and daylight overdrafts may wish to skip the first section and go directly to the analytical material beginning with Section II.

I.

A PRIMER ON EFT NETWORKS AND DAYLIGHT OVERDRAFTS

Types of Networks

Generally, wholesale EFT systems are designed to transfer funds between banks[2] in order to permit a customer (the "sender") of the sending bank to make a payment to a customer (the "receiver") of the receiving bank, or else to be used for payments between banks. In contrast, retail systems, such as automated clearinghouses or automated teller machine networks, are primarily, but not exclusively, concerned with consumer payments. Wholesale wire transfer systems may simply take the form of communications networks that convey instructions to the receiving bank to debit the sending bank's correspondent account and to credit the receiver's account. If the two banks do not have a correspondent relationship, the sending bank may instruct a third bank

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[1] General overviews can be found in David B. Humphrey (1984), Richard L. Smoot (1985), and E. J. Stevens (1984).

[2] Throughout this article, "bank" will be used to refer to any depository institution authorized to use EFT services.

having a relationship with both the sending and receiving banks to debit the sending bank and credit the receiving bank for the amount of the transfer. These networks, of which BankWire and Society for Worldwide Interbank Financial Telecommunications (SWIFT) are examples, have in common the characteristic that they do not themselves provide settlement services, that is, they do not include any mechanisms for consolidating or centralizing transactions between participating banks in order to determine the banks' financial positions in relation to each other. As a result, wire transfers on nonsettling networks are essentially bilateral exchanges.

Adding settlement services to a network characterized by bilateral transfers yields a *gross settlement* mechanism, in which each transaction is settled when made. Because such a network uses a common set of accounts, such as reserve accounts, to determine relative financial positions, the receiving bank saves the costs associated with maintaining and posting entries to correspondent balances. In addition, since settlement occurs immediately, the receiver could have immediate access to "good" funds.

If all transactions between banks were conducted on a bilateral basis, however, increasing numbers of banks and customers in an economy would mean increasing costs due to the sheer increase in volume of transactions that must be handled separately. In order to reduce such costs, participants in payments systems have incentives to reduce costs by consolidating transactions into net debit and credit positions, thereby reducing the number of actual interbank transfers taking place. Specifically, *net settlement,* in which transactions taking place within a specified period are consolidated into net debits or credits for each settling institution, allows each participant to greatly reduce the number of payments and receipts it must make per period. This can in turn take two shapes : in its simplest form, net settlement means that each pair of institutions comprising a payments network would net final bilateral positions at the end of, say, a day, and then arrange payment. Although this would involve a payment or receipt each day between a bank and all others with which it deals, it does create economies by eliminating the necessity for funds to change hands with each separate customer transfer. Further economies may be gained by instituting "net-net" settlement, in which the settling organization maintains a central network account, and collects or distributes each institution's position vis-à-vis the settling organization at the end of each period. As a result, each participant makes only one payment or receipt per period. Because all existing net settlement EFT networks use the latter form, net settlement will be understood to mean net-net settlement in the remainder of this article.

Both gross and net settlement have their own unique advantages. On one hand, gross settlement provides immediate transfer and availability of funds. On the other hand, net settlement has the greater potential for cost reductions due to the consolidation of payments and receipts. It is possible, therefore, for both types of systems to exist side by side. When choosing between systems for a particular transfer, a bank would consider the importance of immediate availability relative to other cost savings.

Large Dollar Wire Transfer Networks

Fedwire. The primary wholesale EFT network in the United States today is Fedwire, operated by the Federal Reserve System. This system, the first national settling network, has existed in various forms since 1918.[3] Settlement originally took place between the twelve regional banks by means of the Gold Settlement Account maintained at the Treasury, and today is accomplished through the Fed's Interdistrict Settlement Fund. Fedwire uses a gross settlement mechanism since, as will be shown, transfers between participants are essentially bilateral, making use of transfers between reserve accounts maintained at the regional Federal Reserve Banks by the participants.

A transaction on Fedwire may take place as follows. A sender, who may be an individual or a private or governmental organization, requests a bank to transfer funds to a receiver. The sending bank debits the sender's account, and requests its regional Federal Reserve Bank to send a transfer message to the Reserve Bank serving the receiver's bank. Banks may be directly connected "on line" by computer with the Fedwire system, or may use telephone or an ad hoc computer link to make contact with their Reserve Bank. The sending bank's Reserve Bank debits the sending bank's reserve account for the amount of the transfer, and credits the receiving bank's Reserve Bank for that same amount. The receiving Reserve Bank debits the sending Reserve Bank's account, and credits the receiving bank's reserve account for the transfer. Finally, the receiving bank notifies the recipient of the transfer, and the receiver is immediately free to use the funds.

This last point deserves emphasis. Fedwire transfers are *final* in that "irrevocable credit will promptly

[3] For a description of payments mechanisms that evolved before the Fed, see John R. Walter (1984).

be given [by receiving banks] to the accounts of customers receiving payments."[4] In other words, the receiver may assume he has "good" funds as soon as he is advised that a transfer has been made. Once made, a transaction cannot be revoked. Further, if the transfer takes place without sufficient funds being provided by the sender, the Fed assumes the risk. Thus, an attractive feature of Fedwire is the certainty it provides to receivers.[5]

Although Fedwire services were originally offered only to Federal Reserve member banks and were not charged for, the Depository Institutions Deregulation and Monetary Control Act of 1980 (DIDMCA) instituted pricing of transfers and gave nonmember banks direct access to Fedwire. The Fedwire system has the highest number of transactions of any wire transfer network. Because the Federal funds market works through Fedwire, and immediately good funds are desired in the money market, there is a continuing high demand for such a gross settlement network. In 1984, approximately 166,410 transfers took place on Fedwire on an average day, with an average transfer size of $2.2 million each. Average daily dollar volume was approximately $366 billion.

CHIPS. The second largest wholesale EFT system is the Clearing House Interbank Payments System (CHIPS), set up in 1970 by the New York Clearing House Association. The original purpose of the network was to clear international transactions of member banks, but it now accommodates domestic transactions as well. Settlement through CHIPS takes place on a net-net basis, and is conducted by a subset of participants known as settling banks. Approximately 138 banks participate in CHIPS, of which 21 are settling banks. Of the remainder, about two-thirds are branches of foreign banks.

A typical transaction may take place as follows. A transfer may be initiated between 7 a.m. and 4:30 p.m. (New York time), during which period payment information messages are sent from the sending bank, through the CHIPS computer, to the receiving bank. The computer in turn notifies the settling banks who have agreed to settle for the sending and receiving banks. This information is posted to the accounts of the participating banks, but no settlement takes place until after close of business. In other words, funds transfers are provisional until settlement at the end of the day.

After 4:30, the computer provides a list of net credit and debit positions of the settling banks vis-à-vis the CHIPS system and the position of the nonsettling banks against their settling banks. By 4:45, this information should be provided to participants. Once this becomes available, the settling banks may notify nonsettling banks of their net positions. As soon as all settling banks agree to settle, those in a net debit position with CHIPS send payment, through Fedwire, to the CHIPS account at the New York Fed. Then, assuming all net debtors have settled, payment is made to settling banks in a net credit position with CHIPS by 6:00. At this time, the CHIPS account should be back to a zero balance, and all that remains are payments between settling and nonsettling banks. Because Fedwire is used for settlement within the CHIPS system, all net transfers are final and there is certainty of the validity of the transfers on the part of participating banks.

Finality of payment does not exist on CHIPS in the same sense as it does on Fedwire. CHIPS transfers are irrevocable on the part of the sending bank, that is, once sent, a payment remains an obligation of the sending bank and cannot be cancelled. Unlike Fedwire, however, the receiver's account need not be credited until final settlement at the end of the day, although the receiving bank is allowed to give immediate credit if it so desires. Thus, transfers are provisional rather than final until settlement occurs.

CHIPS has a smaller number of transactions than does Fedwire, but a higher average transaction size. For example, in 1984, almost 23 million transactions took place at an average rate of over 91,000 transfers per day. Average daily dollar volume was approximately $276.5 billion, and mean transaction size was over $3 million.

CashWire. The third settlement network used in the United States is CashWire, which began full operations on April 1, 1952. This was developed as a settling network from BankWire which, as pointed out above, is a nonsettling network used to exchange payments information and to effect transfers of correspondent balances.

CashWire is a net-net settlement system, and a typical transaction occurs as follows. After a sender notifies his bank that he wishes to make a transfer, the bank transmits the payments information to the BankWire computer, and the information is passed through immediately to the receiving bank. At 4:30

[4] 49 Fed. Reg. 13190.

[5] Transfers are certain due to a combination for finality (Regulation J, Subpart B, 12 C.F.R. $210.36) and the provision that the Fed will have a security interest in the sending bank, not in the receiving bank or receiver, if an overdraft is not covered by the end of the day (12 C.F.R. § 210.31).

p.m. no more transactions are accepted, and a summary of net debit and credit positions is provided to the banks and to the New York Fed. Fedwire is then used by net debtor banks to send funds owed to the CashWire account at the New York Fed. After debit payments are received, Fedwire is again used to remit funds to banks in net credit positions, the CashWire account balance returns to zero, and payment is final.

CashWire has been characterized as providing finality of payment in that receiving banks, in the event of settlement failure, cannot take back funds that have been made available to receivers.[6] Actually, transfers are apparently provisional to receivers until net settlement, so finality on CashWire does not exist for receivers any more than it does on CHIPS. The closest CashWire comes to finality is its "receiver guarantee," according to which banks must make good the amount by which a failed sending bank is unable to meet its net debit position. Specifically, each of the failed bank's creditors is required to make up the shortfall by an amount proportional to its share of the sum of all net credits extended on CashWire to the failed sending bank. This shortfall could be made up from creditor banks' liquid assets, but nothing in the CashWire rules prohibits financing by revoking funds that had been provisionally granted to receivers. Thus, although finality may exist for receiving banks in that a settlement, once computed, will not be cancelled or unwound, it does not exist for receivers until final settlement.

Cash Wire volume is small compared to Fedwire and CHIPS, and daily volume as of August 1984 was only $500 million, consisting of 1,100 transactions per day on average.[7] Participation has also fallen short of expectations.[8] As of Summer 1984, out of 170 BankWire participants, only 22 were members of CashWire as well.

Other wholesale networks. In addition to the foregoing, the Chicago Clearing House Association operates the Clearing House Electronic Settlement System (CHESS), which is open to institutions in the Seventh (Chicago) Federal Reserve District. The most recent addition to the list of networks is the California Bankers' Clearing House Association's Twelfth District Electronic Settlement System (TESS) network for California banks in the San Francisco Federal Reserve District. In Canada, the Canadian Payments Association operates a system that uses net-net settlement through the Bank of Canada, while in England the Clearing House Automated Payments System (CHAPS) acts as a settling network for a set of United Kingdom clearing banks.

Daylight Overdrafts

The major controversy regarding EFT networks concerns the risk exposure of the payments system due to the existence of daylight overdrafts. These occur when payment is made during the course of a business day before the transaction is covered with "good" funds. In other words, at least one of the institutions involved extends free credit that will be repaid before the end of the day.

Daylight overdrafts on gross settlement networks are not identical to those on net settlement networks. On net settlement systems, overdrafts are of an ambiguous nature. Since participants on such systems do not settle until the end of the day, the only overdrafts (in the strict sense) that occur are, first, between a sender who has not yet provided funds to cover a transfer and a sending bank that allows that transfer to go ahead immediately ; and, second, between a receiver and a receiving bank that allows the receiver to use funds before settlement occurs. Both of these may be thought of as normal credit judgments which banks are called upon to make. One possible definition of a daylight overdraft on a net settlement network, then, is the extent to which receivers have been allowed to draw on provisional transfers. Another possible definition is the amount by which a bank's net debit position across all networks exceeds its reserve account balance with its Federal Reserve Bank.[9] In actual policy discussions, however, daylight overdrafts on the private networks are assumed to occur whenever a bank is in a net debit position, regardless of reserve account balance. Thus, by this definition, daylight overdrafts are an inescapable result of the nature of a net settlement system, in which at least one participant must be a net debtor.

On a gross settlement network such as Fedwire, a daylight overdraft has a more straightforward definition. Specifically, it refers to a transfer that has been made and becomes final even though the sending bank's reserve account did not contain sufficient

[6] See, for example, 49 Fed. Reg. 13190 and Stevens (1984), p. 6.

[7] American Banker, August 28, 1984.

[8] American Banker, August 9, 1984.

[9] The Canadian Payments Association uses a definition similar to this on its net settlement network. If an institution's net debit exceeds its clearing balance, it receives an advance from the Bank of Canada which must be paid back with interest.

funds for the transfer at the time it was made. Alternatively stated, the sending bank's reserve account balance has gone negative.

On Fedwire, daylight overdrafts occur due to the way in which Regulation J, Subpart B is written. One section states that payment is final once the receiving Reserve Bank sends it to the receiving bank or else notifies the receiver of the credit. In addition, this section makes it clear that finality means that the receiver has the right to immediate use of the funds.[10] Another section requires a sending bank to have sufficient funds in its reserve account *at the end of the day* to cover net debits for that day.[11] Thus, by granting immediate use of transferred funds while giving until the end of the day to cover debit positions, the opportunity for, as well as legality of, daylight overdrafts arises. Interestingly, the same section that gives the sending bank until the end of the day to provide cover also empowers a Reserve Bank to "refuse to act on" a transfer that "it has reason to believe" may incur an overdraft, so that overdrafts are apparently both permitted and frowned upon.[12]

It is not entirely clear how the regulation came to be written so as to permit daylight overdrafts. Such overdrafts probably occurred under the pre-1971 Fedwire system, which relied on manual accounting and teletype notification of transfers. Since Reserve Banks normally could not provide immediate information as to the current intraday status of a bank's reserve account, it is probable that wire transfers took place before it was known that a sending bank had sufficient covering funds in its reserve account. During this period, there were no systemwide regulations specifically covering wire transfers, and any rules that existed were contained in individual Reserve Bank operating circulars. Thus, it may be argued that Regulation J, when it was finally rewritten to include wire transfers, simply formalized what had already been taking place. However, when the Board of Governors first proposed that Regulation J be revised to cover wire transfers, the relevant section permitted transfers subject to the restriction that "each transferer shall maintain . . . a daily net balance sufficient to cover the transfers of funds debited to its account."[13] Given this language, it is not clear whether daylight overdrafts were to be permitted or not. This was changed to the present policy in the 1976 proposal, and the reason given was "to clarify the amount of the balance which a member bank must hold with its Federal Reserve Bank."[14] Indeed, given the technology in place at that time, daylight overdrafts most likely could not have been effectively controlled without major costly changes to the system. In addition, reserve balances at that time were higher than they have been since the Monetary Control Act of 1980 imposed universal, but lower, reserve requirements.

Once daylight overdrafts are permitted on a gross settlement network, the distinction between a gross and net settlement system begins to break down. Although Fedwire's transfers are final when made while those on the other systems are not, sending banks incurring overdrafts on Fedwire are allowed to settle on a basis similar to that found on the private networks. The distinction would be even less significant if participants in the networks were to grant immediate irrevocable credit to their receivers.

II.

RISK AND WHOLESALE PAYMENTS NETWORKS

Risk Concepts

In order to gain some insights into the economic aspects of payments system risks, assume there exists a simple settlement network for banks in an economy which permits overdraft transfers subject to their being repaid by the end of the day, but does not guarantee that settlement will take place and does not provide for finality of payment. This network may use either gross or net settlement via a central set of accounts. Banks undertake transfers for the benefit of third parties (senders and receivers), and are compensated by fees net of operating costs.[15] Finally, all payments are risky, that is, it is uncertain whether or not an overdraft transfer will be covered. This uncertainty means that costs may be borne by participants in the payments system. Such costs, known as expected costs, are determined by multiplying the magnitude of loss and the probability of such a loss occurring.

Credit risk arises from uncertainty that funds credited will actually be received, and is faced as a

[10] 1.2 C.F.R. § 210.36.

[11] 12 C.F.R. § 210.31.

[12] Banks are not permitted to run overnight overdrafts, and violators are subject to a penalty rate. See Regulation D, 12 C.F.R. § 204.7 and various Reserve Bank operating circulars.

[13] 38 Fed. Reg. 32954 (1973).

[14] 41 Fed. Reg. 3098 (1976).

[15] For a model that emphasizes the jointness of both costs and benefits on payments systems, see William F. Baxter (1983).

private expected cost by the sending and receiving banks and the receiver. This may in turn be broken down into sender risk and receiver risk. In terms of the simple payments system described above, sender risk refers to the fact that a sending bank faces an expected loss whenever it extends overdraft credit to a sender. In other words, it is the risk that the sender will not provide covering funds and is by no means unique to EFT systems. At the other end of the transaction, the receiving bank faces receiver risk, which arises due to uncertainty whether or not a sending bank will settle.[16] In addition, if the receiving bank were to allow the receiver to draw on provisionally transferred funds, the receiver also faces expected costs due to the possibility that his bank may attempt to revoke his funds in the event of settlement failure.

Systemic risk refers to the expectation that failure of one bank to settle will cause another bank or banks to fail to settle as well. This would arise if, within a particular bank, ability to settle debit positions depends on receipt of credits. Default of a particularly large net credit (in relation to total liquid assets) may keep a bank from meeting its obligations to other banks against which it is in a net debit position. In turn, this failure could conceivably cause settlement failures at other banks who depend on credits from the receiving bank to meet their debit positions, and so on. Thus, systemic risk refers to expected costs that are not borne solely by the incurring bank but by other participants in a payments network as well. In other words, a receiving bank that accepts a transfer and allows a receiver to draw funds before settlement incurs not only private costs due to credit risk but also external costs that are borne as receiver risk by other banks in the system. These latter costs, known as externalities, may not be borne exclusively by the receiving bank's creditor banks, but also by banks to whom these creditors are in overdraft positions. Thus, in accepting a transfer, a receiving bank can be expected to take into account its private credit risks but not these additional social costs. The end result in the simplified payments system is an incentive for receiving banks to accept riskier transfers than would be the case if these banks were to bear all their costs privately.

The distinction between private and external costs is important for the following reason. Since receiver risk is borne privately by a receiving bank, this bank may be expected to have incentives to keep such costs to a minimum. Specifically, a bank may wish to control its exposure to sending banks it has reason to believe may default on credit positions. However, systemic risk is borne by other banks in the system, so that this same bank may not have incentives to limit risks to which it exposes other banks. In other words, there is little reason to expect this bank to place as much emphasis on controlling its net debit position against the rest of the system as it would place on controlling its exposure as a creditor to other banks.

In this simple system, it should make little difference for risk purposes whether a network uses net or gross settlement. Under the former, sender risk would exist until an overdraft is covered, while receiver risk would exist until final settlement. Under the latter, both sender and receiver risk would exist until the overdraft is covered. Assuming all such transactions under either system must be covered by the end of the day, potential risk on net settlement networks is the upper limit for that on gross settlement networks.

Risk Assignment Under Varying Institutional Structures

Both CHIPS and CashWire have some similarities to the hypothetical payments system described above. There is no finality for receivers, nor is there explicit guarantee of settlement to receiving banks. Thus, all the risks found in the hypothetical model are also found in the private networks. Sender risk exists for those banks sending transfers for customers who have not provided cover at the time of transfer. Receiver risk exists until final net settlement occurs at the end of the day. If the receiving bank allows a receiver to draw funds before settlement, it is exposed to risk even though the receiving bank may try to recover the funds from the receiver. In other words, there is no finality of payment to receivers until final net settlement. Thus, receiver risk is borne by both receiving bank and receiver. Less directly, the sender may also be at risk because, if a receiving bank successfully recovers funds from a receiver after failure of a sending bank, the receiver may have cause for action to recover payment from the sender. In turn, this sender may have already supplied funds to the failed bank.

Systemic risk is present on this simplified version of the private networks because a bank may depend on a credit from a failing bank to pay other banks against which it is in a net debit position. If a

[16] Stevens (1984) combines sender and receiver risk into settlement risk.

CHIPS member fails to settle, and no other bank will settle for that member, all debit and credit messages for this sender may be cancelled and a new settlement computed. Systemic risk arises here because of possible dependence of other banks on credits from the failed bank. The cancellation of the messages does not relieve the failing bank of obligation to ultimately settle because CHIPS transfers, once sent, are irreversible. However, this does not affect systemic risk since it is highly improbable that funds could be recovered during whatever remains of the day before settlement. On CashWire, as noted above, losses are apportioned among creditors. Although this does not by itself eliminate systemic risk, it does appear to localize problems.[17]

Adding finality of payment, under which immediate and irrevocable credit is granted to receivers, to the hypothetical system varies the risk assignment somewhat. Sender risk does not change, but receiver risk, which was previously shared by the receiver and the receiving bank, is narrowed to the receiving bank. One would expect this new risk assignment to lead to incentives on the part of receiving banks to monitor the soundness of sending banks from which they receive transfers. At the same time, receivers (and, as will be shown, senders), will have fewer incentives to monitor sending banks.

Adding guarantee of settlement to finality adds an additional party, the insurer, to the hypothetical payments system model, thereby approximating the risk assignment on Fedwire. Finality removes risk from the receiver, thereby confining receiver risk to the receiving bank. However, the Fed, as insurer, guarantees that settlement will occur, that is, that the overdraft will be covered. In the event of settlement failure, the Fed has recourse to the failing bank,[18] although the amount eventually recovered is uncertain. Thus, receiver risk is assumed by the Fed and consists of expected losses net of amounts expected to be recovered from the bank that failed to settle. Because any loss would reduce Fed net revenues available for transfer to the United States Treasury, the risk is ultimately borne by the public. Sender risk on Fedwire does exist, and may be borne by the sending bank and the Fed. However, since receiver risk is shifted from the receiving bank to the public, failure to settle is localized and will not affect the position of any other bank. Still, it is important to emphasize that no receiver risk has been eliminated; rather, it has simply been socialized.

The question of what happens to systemic risk is more complex. If banks no longer face receiver risk, they cannot face systemic risk so, at first blush, it appears that systemic risk has been eliminated. Certainly the externality has not been placed on the participating banks, since banks are not made to take these costs into account when choosing whether to accept a transfer. However, from the point of view of the insurer, that is, the Fed, systemic risk is someone's receiver risk. This is analogous to the fact that externalities are the sum of private costs borne by individuals other than those incurring them. For example, when a factory causes pollution, it inflicts costs on nearby landowners. The sum of these costs is the externality incurred by the polluter. If the factory owner is made to compensate the surrounding landowners for the pollution he has caused, all the pollution costs are turned into private costs to the polluter. Similarly, the total risk assumed by the insurer is the sum of receiver risks in the system, and in assuming all receiver risks the Fed has thereby assumed systemic risk as well.

Insurance of receiver risks in the Fedwire system means that, other things equal, costs faced by banks when exchanging payments messages are lower than they would otherwise be without insurance. As a result, supply of messages is increased. In other words, since banks need no longer concern themselves with receiver risk, they may tend to accept transfers from sending banks who may have been turned down if no insurance had been provided. Thus, the Fed provides a valuable service to each bank by assuming receiver risks. Since the Fed's insurance is provided at zero price, banks have little incentive to reduce exposure to overdraft transfers.

It may also be argued that the Fed also provides implicit insurance on the private networks through its role as lender of last resort. According to this line of reasoning, the Fed would never sit back and allow systemic failure, and would surely step in by lending to banks in net credit positions with a failed bank in order to contain the effects of any settlement failure. If this is indeed the case, then the final assignment of costs depends on what happens to the receiving banks affected by a sending bank's failure. Here, it is important to distinguish between illiquidity and insolvency.

If a receiving bank's problem is insufficient liquid assets to make up the sending bank's shortfall, discount window lending to the receiving bank in order

[17] Nothing in the CHIPS rules appears to preclude the New York Clearing House Committee from dealing with settlement failure in the same manner as that specified for CashWire.

[18] 12 C.F.R. §210.21.

to allow settlement to proceed would have the immediate effect of eliminating systemic risk. However, since the receiving bank would have to pay back the loan plus interest to the Fed, that bank would end up bearing the receiver risk net of any amounts eventually recovered from the failed sending bank. Further, the Fed will be compensated for the credit it has extended to prevent failure. Finally, the externality cost will be placed on the borrowing bank, since by averting failure due to illiquidity, the borrower is prevented from passing costs on to its creditor banks. Thus, if failure of one participant in a system causes liquidity problems for its creditors, discount window lending to the failed bank's creditors will both prevent systemic failure and assign costs to receiving banks and receivers. This in turn would increase incentives to monitor sending banks.

Insolvency presents a more complex set of circumstances. If a bank in a net debit position fails without warning before net settlement occurs, it is possible that one or more receiving banks may eventually become insolvent as a result. In this case, the assignment of costs will depend on to whom the Fed lends. If the Fed advances credit to the failing receiving banks in order to allow settlement to proceed, then the costs will ultimately be borne by the Federal Deposit Insurance Corporation fund and the public. In this case, the external costs are not placed on the failed banks, although the discount rate represents a price of the Fed's assuming the risk of having to bear these costs. If the Fed only advances credit to banks experiencing liquidity problems as a result of some receiving banks failing, then the assignment of costs is identical to that described in the previous paragraph.

It is important to emphasize that the preceding analysis depends on the assumption that the Fed lends to receiving banks in net credit positions with the failing bank. If, on the other hand, discount window advances were made to the failing bank simply to allow settlement to proceed, costs would, as in the case of insolvency, be shifted to the FDIC and public and not to the receiving banks. In this case, as with Fedwire, receiving banks would have little incentive to monitor sending banks. Thus, banks' incentives to control risk exposures may be related to their perceptions of to whom the Fed is likely to lend in the event of settlement failure.

To sum up, the crucial difference between risk assignment on Fedwire and that on the private networks stems from the manner in which transfers are guaranteed. On Fedwire, losses due to failure to settle are borne by the public free of charge. Therefore, since sending banks are not made to take account of external costs involved in making transfers, there is an oversupply of transfers. On the private networks, however, risks are placed on receiving banks because banks will have to repay the lender of last resort the amounts borrowed to cover a sending bank's failure to settle. Since interest is charged for this lending, the externality should be passed back to the banking system, and should be faced as a cost by banks when accepting transfers from each other.

III.

POLICY RESPONSES

The complexity of payments systems institutions, to say nothing of the overdraft problem itself, makes it critical that any policies instituted to control risk be selected thoughtfully and deliberately. Using the framework developed above, this section will analyze five policy alternatives. Two of these, pricing and an intraday funds market, explicitly rely on the price system to reduce risks. Two others, banning daylight overdrafts and placing restrictions on overdrafts, explicitly reject price incentives. The fifth, finality of payments, creates an assignment of liabilities among parties to a transfer in order to provide incentives to monitor risks. All five will be looked at in terms of how they affect risk assignment, what incentives they will create, and whether they may be reasonably expected to attain their stated objectives. Following this discussion, recent policy initiatives from the Board of Governors will be described.

Analysis of Policy Alternatives

Ban daylight overdrafts. As was pointed out in the first section, daylight overdrafts on net settlement systems actually refer to net debit positions. Since if one or more parties on a net settlement network are net creditors, then at least one other party must be a net debtor. It follows that banning daylight overdrafts on private networks would mean that a bank could incur a debit only if it were receiving an offsetting credit in return. Such a ban would, in all likelihood, be so costly as to eliminate net settlement systems entirely.

Daylight overdrafts could be banned on a gross settlement network. If daylight overdrafts on Fedwire were totally forbidden, so that transfers could only be made if banks had sufficient funds in their reserve accounts to cover them, sender risk would still exist to the extent that sending banks extend

overdraft credit to their sending customers. However, receiver risk to the public would be eliminated. Thus, from a risk reduction standpoint, banning overdrafts would be the most effective course of action, at least as far as Fedwire is concerned. Unfortunately, such a policy would be fraught with difficulties.

Forbidding Fedwire overdrafts would be costly to the banking system and its customers because transfers would have to be held until covering funds were provided, thus depriving institutions of flexibility in making transfers. The results would be the intraday analogue of forbidding short-term credit by which businesses bridge gaps between payments and receipts. Of course, this is not to argue that the current level of overdrafts is somehow optimal, but rather that some overdrafts may be justified on efficiency grounds.[19] If daylight overdrafts are permitted, however, there is no reason why they should be given away as free credit.

From an operational standpoint, banning daylight overdrafts would be costly if one were to insist on "real time" (second-to-second) monitoring of Fedwire transfers in order to stop overdrafts before they occurred. A less costly approach would be to monitor transfers ex post and then to levy heavy penalties in order to deter would-be violators. Finally, a strict ban on daylight overdrafts on Fedwire could easily be evaded by shifting transfers to one of the private networks.

Establishment of an intraday credit market. Daylight overdrafts could eventually be banned if an intraday Fed funds credit market were to evolve. There, credit would be available for periods of less than 24 hours, possibly by lending for four-hour increments. If such a market existed, a sending bank could make the decision whether to borrow in order to send immediately or else to wait until covering funds were on hand. This would preserve the flexibility of the present system, but would shift risk to intraday lenders rather than to the Fed. Further, since risk would be borne by lenders only for a price, the costs described above would be placed back on those banks that incur them.[20] Most importantly, since intraday credit would no longer be unpriced, borrowers would have incentives to economize on risks they incur. Since effects of such a system on resource allocation are similar to pricing, further discussion will be suspended until the following section.

Pricing. An alternative perspective on the overdraft problem can be obtained from the economics of information and uncertainty.[21] Microeconomic theory asserts that, given a choice between, say, receipt of $200 for certain and a fifty percent chance of $1000, a rational person may prefer the certain $200. In other words, even if this person could expect to win $500 in such a gamble on average, he may be willing to give up some expected winnings in order to reduce uncertainty. This behavior is referred to as risk aversion, and one of its implications is that risk-averse individuals are willing to pay to have uncertainty reduced, that is, they are willing to buy insurance at some price.

Assuming that the stockholders of banks participating in a payments network are risk-averse, it follows that they would be willing to pay a positive amount to have receiver risk reduced. In other words, insurance of receiver risk is a valuable service to banks. Thus, the Fed's nonpriced guarantee of Fedwire overdraft transfers is in effect a subsidy to the stockholders and customers of participating banks. The amount of the subsidy is not the actual amount of overdrafts, but rather the premium that bank owners would be willing to pay to have receiver risk assumed by the insurer. If this insurance were explicitly priced, not only would the subsidy be recovered but banks would have incentives to take account of the risks they place on the payments system. Thus, although credit risk would still be assumed by the public, it would not be assumed for free.

One advantage of pricing Fedwire overdrafts is that it acknowledges that a certain amount of overdrafting may be optimal insofar as it helps maintain an "efficient" payments system that avoids a gridlock in which the whole system becomes jammed due to delayed transfers. Overdrafts could be monitored on an ex post basis and then charged for, say, at the end of the month. Banks would, as a result, be made

[19] For example, it has been argued that banks in unit banking states must depend on daylight overdrafts more heavily than do banks in other states. (Chicago Clearing House (1984), Appendix A) In addition, many overdrafts are apparently the result of current practices of banks buying and selling federal funds. To the extent that these practices simply reflect institutional practices that evolved as the result of permitting overdrafts, they do not affect the arguments presented here.

[20] Cf. Kenneth J. Arrow's (1969) characterization of the externality problem as "a special case of a more general phenomenon, the failure of markets to exist."

[21] See, for example, John D. Hey (1979).

aware that they impose costs on the system, and thus would have incentives to delay at least some transfers until covering funds become available. In addition, charges made on the basis of percentage of overdrafts would bear some relation to risk exposure, certainly a closer relationship than that found in the current practice of charging a flat fee for wire transfers regardless of overdraft position.

Pricing of overdrafts on Fedwire may also be desirable from the standpoint of public policy regarding competition between payments service providers. Since Congress passed the Monetary Control Act of 1980, the Federal Reserve System has been placed in the somewhat awkward position of both regulator and competitor of private banks. Although the Act contains no specific mention of "fair" competition with the private sector, the legislative history of the Act shows that Congress clearly was concerned with this subject. In fact, some have recommended that the Federal Reserve Act be amended to make such competition an explicit objective of Fed policy.[22] Despite the ambiguity of current law, however, the Board of Governors has expressed its "fundamental commitment to competitive fairness" and stated as a matter of policy that "Federal Reserve actions are . . . implemented in a manner that insures fairness to other providers of payments services."[23] Thus, since guarantee of settlement in the form of free intraday credit constitutes a competitive advantage of Fedwire over the private networks, pricing may help to stimulate competition in the provision of payment services.[24]

The major obstacle to implementing a pricing scheme on Fedwire is that it is not obvious what the appropriate price for either insurance or intraday credit is. Risk premia most certainly exist in a world of risk-averse individuals, but measuring such premia would require data that are typically not available, such as how much risk bank stockholders are willing to tolerate and the probability of settlement failure occurring. A market price for intraday credit does exist in the form of the broker call rate charged brokers for day loans, which are made so that a broker can certify a check used to pay for securities. This rate tends to float about 100 basis points above the Fed funds rate, and the loans are repaid by the end of the day.[25] The main problem with this form of pricing is that it charges a one-day rate whether the actual loan lasts a few hours or the whole day. There is no reason, however, why the rate could not be computed for shorter periods. An alternative means of pricing is to use the tax-adjusted difference between the rates on go-day bank certificates of deposit and Treasury bills as an approximation of the price of default risk.[26] The problem with this approach is that this difference fluctuates widely, and disentangling default risk from tax effects is likely to be a formidable task.[27] As another alternative, overdrafts could be charged the Fed funds rate extrapolated backwards to periods of less than 24 hours. If such a rate is too high, then it is likely that an intraday credit market would develop. If it is too low, at least it will provide incentives in the desired direction, that is, toward fewer overdrafts. Finally, a price for overdrafts could be computed from the discount rate. Since this rate is typically lower than the Fed funds rate, it is less likely to lead to an intraday funds market.

While pricing daylight overdrafts may be desirable on Fedwire, it does not necessarily follow that net debits on the private networks should be explicitly priced as well. As pointed out above, if the Fed stands ready to lend through the discount window in order to prevent systemic failure due to illiquidity of receiving banks, the costs incurred by the failed bank will most likely be borne by the banks in net credit positions against the failed bank. Since these costs represent expected costs to participants in net settlement networks, banks should take them into consideration when deciding on risk exposures. Thus, although explicit pricing of risks does not exist on the private networks, there is implicit pricing so long as banks expect the Fed to lend to net creditor banks experiencing liquidity problems due to the failure of a net debtor to settle. In addition, although the public may bear some losses if one or more of the receiving banks fails and is unable to repay borrowed funds, the Fed is compensated for taking this risk because interest is charged on discount window credit. The main problem for policymakers is to ensure that sufficient collateral is on hand to facilitate discount

[22] See Raymond Natter, "Legislative Intent Regarding Pricing of Services by the Federal Reserve Board" in U. S. Congress, House of Representatives (1984), pp. 81-91; for the recommendation, see p. 8.

[23] Board of Governors of the Federal Reserve System (1984), pp. 710, 712.

[24] The Department of Justice has also expressed its concern with such an advantage, and has suggested consideration of pricing. See U. S. Department of Justice (1984), pp. 7, 34-5.

[25] For a discussion of day loans, see Gardiner B. Van Ness III (1975), pp. 143-52.

[26] Humphrey (1984), pp. 100-l.

[27] See Timothy Q. Cook and Thomas A. Lawler (1983).

window lending should systemic failure be threatened.[28]

The existence of implicit pricing on the private networks calls into question the assertion that certain intervention by the lender of last resort creates a "moral hazard," that is to say, leads network participants to devote fewer resources to monitoring the riskiness of sending banks than would otherwise have been the case, thereby increasing the probability of settlement failure.[29] For moral hazard to exist, however, it would be necessary for banks to be able to shift the costs of their failure to monitor to other banks. At least in the case of temporary illiquidity of receiving banks, it is difficult to see how such cost shifting could occur, since borrowers must pay back, with interest, funds advanced by the Fed. Thus, if banks are not observed to engage in extensive risk monitoring, it may be due not to moral hazard but rather to their perception of a very low probability of settlement failure.

Finality of Payment. As mentioned above, finality exists on Fedwire but not on CHIPS or CashWire. In essence, finality of payment establishes a strict liability rule under which a receiving bank is made liable for all payments it accepts. Regardless of whether or not the receiving bank could have foreseen the failure of a sending bank, the receiving bank would have no recourse to the receiver. The rationale for such a condition is that overall costs would be minimized by focusing them on the party to the transaction who can reduce risks at lowest cost.[30] In other words, the receiving bank is made to bear the costs of a settlement failure because it is believed that this party is in the best position to monitor and avoid such costs. Although finality would not by itself reduce risks, it has been justified as a means of risk concentration that would in turn induce banks to take risk reduction measures, thereby minimizing costs to all parties.[31]

It is possible, however, that the receiving bank may not necessarily be in the best position to monitor sending banks, since it would require each bank to perform a credit evaluation of each participant in the system. Although rating firms exist to evaluate creditworthiness, it may be costly to obtain continually updated ratings. Thus, it may be preferable to place some liability on senders and receivers as well. There would be at least two advantages to such an assignment. First, customers using large dollar transfer networks to send funds are likely to possess the sophistication to monitor the banks with whom they deal. Second, they would, as customers, probably have fewer banks to monitor than would banks participating in a funds transfer network.

If a sending bank fails before net settlement on a network with no finality, a receiving bank that had allowed a receiver to use funds before they were finally received may now attempt to take back those funds. If the attempt is successful, the receiver now has reason to take action against the sender to recover a payment. This exposes the sender to liability. This is especially severe since that sender may have actually provided funds to the failed sending bank. If he had, then he must both attempt to recover from the failed bank and also will be subject to action by the receiver demanding payment. Thus, the sender will have incentives to monitor the riskiness of the sending bank he selects. At the same time, due to the uncertainty of recovery from the receiver by the receiving bank, there still will be incentive for this bank to monitor the riskiness of sending banks.

Finality of payment, then, is justified only if it can be shown to be the cost-minimizing assignment of liabilities. If monitoring of sending banks is costly, then it may be preferable to spread liability in order to give other parties incentives to monitor. The benefits of finality become even more dubious when one considers that lack of recourse to transferred funds may increase the probability of settlement failure for a receiving bank, and thereby increase systemic risk as well. Although finality may "insulate the nonbank sector from the effects of a settlement failure,"[32] it is not at all clear that it creates the incentives that would minimize risks from a social standpoint.

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[28] Institutions that do not have access to the discount window could be required to collateralize all daylight overdrafts, or else these institutions could be forbidden overdrafts.

[29] Stevens (1984), p. 11.

[30] This corresponds to the "cheapest cost avoider" in Guido Calabresi (1970), pp. 135-40.

[31] See Stevens (1984), pp. 10-11. Stevens also suggests that a "hands-off" policy by the Fed toward settlement failure would create incentives similar to those claimed for finality.

[32] 49 Fed. Reg. 13190.

Nonprice rationing of overdrafts. Approaches to payments system risk that ration daylight overdrafts seek to control either a bank's exposure to risk from sending banks or else the amount of risk one bank creates for the rest of the payments system. Indeed, such measures have been recommended by private sector studies.[33]

Net bilateral credit limits are drawn up by a receiving bank and specify the maximum net transfer the bank will receive from a particular sending bank.[34] By limiting the size of a net transfer, exposure of a receiving bank to a sending bank is kept within bounds. Since failure of a sending bank would inflict costs on a receiving bank, it is likely that, if bilateral limits were an effective risk reduction measure, banks would institute them. Further, if finality of payment were imposed on a system, receivers may have greater incentives to establish bilateral limits. Indeed, all private payments systems now have such limits in place.[35] However, such a measure is not without problems.

The most serious problem with bilateral credit limits is, as in the case of finality, the cost of making judgments about individual banks in order to set actual limits. Judgments would include determining for which banks to set limits, gathering information, analyzing information, and updating the limits as conditions change. Since many banks would be faced with large numbers of judgments to make, some sort of categorization may be necessary in order to obviate a separate study for each sending bank. However, this would involve a loss of detailed information, which would in turn make the resulting bilateral limits less useful.

A second problem with net credit limits is that they, like most nonprice rationing schemes, tend to be inflexible and therefore costly. Suppose a receiver is expecting a payment over a private network, but that the payment exceeds the receiving bank's net credit limit. If limits were rigid and could not be easily modified, they would preclude the bank from accepting the payment, even if there were no doubt as to the sending bank's solvency.[36] In actual practice, however, limits can be lifted to cover such situations, The result is that flexibility is preserved but the value of the limits as a risk reduction tool may be called into question.

The third problem with bilateral limits is intimately related to the second. If limits are set at relatively low levels, they may reduce risks but may also send business over to Fedwire, where no such limits exist. This problem would be even more acute if finality were imposed on private networks. Thus, the problem of competitive equity between public and private networks again rears its head.

Net debit caps attempt to control the risk a bank poses to the banking system by limiting the amount by which a bank may be "in the red" on a network or across networks.[37] Such a measure should be effective for reducing both receiver risk and systemic risk. Unfortunately, such caps have the same disadvantages of inflexibility as do net credit limits, although they do not involve as costly a set of information requirements to implement. In addition, since net debit caps would control costs external to individual banks, it is unlikely that these banks have strong incentives to establish binding caps that are likely to limit risks to acceptable levels, Thus, such caps, if adopted, would probably have to be developed by a collective effort of banks or, failing that, imposed by regulatory fiat.

Net bilateral credit limits and net debit caps may be characterized as measures which limit risks by limiting the choices of banks without altering the underlying incentive structure. In other words, neither may be expected to affect risk assignments among network participants, but rather to control the amount of risk assumed. Because both may prevent some transfers from taking place, they are likely to reduce risks in the short run. Over the long run, net bilateral credit limits are likely to prove useful to banks as means of controlling exposure to other banks in the system. However, it may be in some institutions' interests to find ways to circumvent such restrictions as net debit caps, thereby short-circuiting risk control policies. For that reason, it may be necessary in the future to institute additional policies that more directly affect the incentives of payments network participants.

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[33] See, for example, Association of Reserve City Bankers (1983), pp. 23-25.

[34] 49 Fed. Reg. 13189.

[35] CHIPS was the last system to institute bilateral net credit limits. American Banker, December 5, 1984.

[36] A likely response is to divide the payment between two networks.

[37] 49 Fed. Reg. 13188. CashWire has net debit caps of 50 percent of capital, while CHIPS is experimenting with a more complex system of caps.

Recent Policy Initiatives

As mentioned above, all private networks now have bilateral net credit limits in place. In October 1984, the Association of Reserve City Bankers (ARCB) Risk Control Task Force issued a report outlining a procedure for setting up a voluntary system of net debit caps.[38]

The caps would work as follows. Financial institutions would evaluate themselves in the areas of creditworthiness, operational controls and procedures, and credit controls. The ratings in these three areas will then be combined in order to give an overall rating-exceptional, satisfactory, or less than satisfactory. The rating would determine whether a bank would be permitted to overdraft across systems up to 2.5, 2, or 1.5 times capital, respectively. However, the limit would not apply to individual overdrafts but rather to the average maximum overdraft over a two-week reserve period. Finally, the caps would be applied across: all wholesale EFT networks, including Fedwire.

In May 1985, the Board of Governors met to discuss risk reduction measures. Generally, they agreed with the ARCB recommendations, but instituted two major changes to the net debit cap system.[39] First, in addition to a cap on average maximum overdrafts, banks will be asked to set higher caps on maximum daily overdrafts. Controls will be applied by banks to both average overdraft size and how much these overdrafts will be allowed to vary from the average. Second, average caps were reduced by fifty percent of capital for each rating category, so that a bank rating itself in the highest range could not overdraft more than twice its capital. The Board also added a fourth, lowest category, the members of which could not overdraft at all.

The regulators' role in this self-regulatory mechanism would be for examiners to review the self-evaluations and to point out areas of disagreement. Such a role is actually compatible with a results-oriented approach to regulation, in which specific objectives are established by regulators but implementation is left to the regulated industry. The older, alternative approach would be for the regulator to require specific actions to accomplish the objectives. This latter approach would only be brought into play if the former approach fails.

[38] Association of Reserve City Bankers (1984).

[39] 50 Fed. Reg. 21120 (1985). In addition, networks requesting net settlement services from the Fed will be required to institute bilateral net credit limits.

IV.

CONCLUDING COMMENTS

On its surface, the risk reduction problem has all the earmarks of the economic problem of collective action, that is, actions that are in the interest of depository institutions as a whole are not necessarily in their interests as individuals. If this accurately describes the situation with regard to systemic risk, then the current "voluntary action in lieu of regulation" solution is warranted. Because the alternative to voluntary action is more stringent imposed regulatory solution, the banking industry may well have incentives to attempt to reduce overdrafts by means of a self-regulatory mechanism.

However, this article has attempted to demonstrate that while the problem is complex, the solution need not be. On Fedwire, risk is being assumed by the public because intraday credit is granted free of charge to participating depository institutions. Thus, some sort of pricing of overdrafts or an intraday funds market may be called for. Even with pricing, Fedwire would continue to be in demand because it, unlike the private networks, provides immediate transfer of funds, On the private networks, however, pricing is not called for because risks are borne by participating banks. If the Fed lends to receiving banks through the discount window in order to prevent a systemic failure, the borrowing institutions will bear the cost, and may be expected to take this cost into account in their credit decisions. Further, even without finality of payment, it appears that costs due to settlement failure are assigned to parties that have incentives to monitor, should they perceive the potential for losses to be significant. All that is required is a commitment by the lender of last resort to supply net creditor banks the necessary liquidity to prevent a settlement failure from becoming a systemic failure, and the proper collateralization to insure that lending can proceed.

Recently, the Board of Governors has established a risk reduction policy for large dollar transfer networks. Although this policy relies largely on non-price risk control measures, the Board made it clear that it intends as a matter of long-term policy "to reduce further the volume and incidence of daylight overdrafts and other uses of intraday credit."[40] As experience is gained with risk control policies, it may be desirable in the future to consider measures that provide additional economic incentives for banks to take account of risks they create.

[40] Ibid., p. 21121.

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