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LEGAL AND REGULATORY REFORM IN ELECTRONIC PAYMENTS:
AN EVALUATION OF FINALITY OF PAYMENT RULES

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Each day, approximately \$1.3 trillion changes hands by means of wholesale wire transfers.¹ Of this total, about \$638 billion is exchanged on Fedwire, the Federal Reserve wire transfer network, while just under \$622 billion moves over the privately-owned Clearing House Interbank Payment System (CHIPS). On Fedwire, the average transfer is \$2.9 million, while transfers on CHIPS average \$4.6 million.

With such substantial amounts involved in virtually instantaneous transactions, it is not surprising that concern has arisen over risks that a large network participant will fail to settle its obligation to the network. Consequently, the Board of Governors of the Federal Reserve System has adopted risk control measures designed for both Fedwire and CHIPS.² But despite the measures in place, further changes have been suggested. On Fedwire, for example, explicit pricing of daylight overdrafts has been proposed in order to make network participants aware of the risks they incur.³

On private net settlement networks like CHIPS, however, explicit pricing of net debits would be more complex. As a result, risk allocation rules, known as finality of payment rules, have been proposed for CHIPS.⁴ Finality rules specify when payment between particular parties to a transaction is irrevocable. The purpose is to assign risks to the parties in such a way as to give them incentives to reduce the risks they face. In the language of the economist, they seek to internalize the costs of a settlement failure in order

¹"Wholesale" wire transfer and the wholesale wire transfer networks are described in the Appendix. Network payment volumes are for March 1988.

²Board of Governors (1985, 1977).

³Mengle, Humphrey, and Summers (1987).

⁴See, e.g., Humphrey (1986), pp. 111-15.

to lead market participants to control them. Such rules could either be adopted by private networks on their own, imposed as regulations, or enacted into law. Whatever form risk control measures take, they would help fill the vacuum left by the ambiguous legal framework within which wholesale wire transfer operates.

Finality rules are of interest now because of the current effort by the National Conference of Commissioners on Uniform State Laws to draft provisions of the Uniform Commercial Code to explicitly codify a law of electronic funds transfer. The outcome of this effort will determine the future statutory environment within which rights, obligations, and risk assignments of network participants are established and clarified. In addition, codifying a wire transfer law will shape private sector and regulatory incentives to seek further risk control measures. The more detailed the wire transfer provisions of the UCC, the less scope there is for detailed regulation.

This paper has two objectives. The first is to evaluate various finality rules that could be adopted, either by law or regulation, to allocate risks of a settlement failure. The second is to evaluate the desirability of using the law versus using regulation to adopt a particular finality rule.

As will be seen, it is possible to write finality rules that assign risks to the parties in the best position to control them. But the effectiveness of such rules depends crucially on two assumptions. First, network participants must have accurate information regarding the risks they face. Second, the parties must actually be required to bear their assigned costs if a settlement failure occurs. If either assumption is violated, the rule will not work as intended and will have little effect on risks. Put more simply, the rule will have no teeth.

Given the problems with finality rules, writing a stringent rule into the law does not appear promising. Even if a finality rule is not undermined by informational or policy problems, the complexity of some rules makes them unlikely candidates for inclusion in the law. Unfortunately, the current (as of this writing) version of the proposed UCC provisions dealing with finality on wholesale networks is neither simple nor likely to induce network participants to reduce risks. It appears that detailed finality rules might better be left to the networks and their regulators, while leaving to the law such tasks as specifying when obligations are discharged and clarifying rights and relationships between parties to a transfer.

I. Background

At present, paper check transactions are governed by Articles 3 and 4 of the Uniform Commercial Code (UCC), along with Federal Reserve Regulations J and CC. The consequence of such coverage is that, even outside the Federal Reserve check processing system, check payments take place in a well-defined legal framework. If disputes arise between parties to a transaction, there is a substantial body of law to guide resolution of the dispute. Further, Section 4-103 of the UCC allows "variation by agreement," that is, divergence from Code provisions (subject to some limitations) either by private contract, Federal Reserve regulations and operating circulars, or clearing house rules. For example, some provisions of Regulation J might conflict with the UCC, but Section 4-103 allows such flexibility while retaining the UCC as a backstop legal framework.

In contrast, electronic funds transfer is covered by a "patchwork of laws and regulations."⁵ Consumer (retail) funds transfer is governed by the Electronic Funds Transfer Act of 1978 (and Federal Reserve Regulation E), the Truth-in-Lending Act, Comptroller of the Currency Consumer Protection Guidelines, some state EFT laws, and others. Wholesale wire transfer has far less coverage. Regulation J governs parts of the typical Fedwire transaction, while CHIPS is covered by network rules and regulations subject to conditions required for access to Federal Reserve Bank net settlement. There is a smattering of case law regarding wholesale wire transfer, but it hardly represents a coherent framework.⁶

What does not currently exist is a comprehensive, explicitly codified legal framework for wholesale wire transfer. While some have argued that provisions of the UCC written for paper checks have analogous applications to wire transfer,⁷ one court said that "maybe the language of Article 4 [of the UCC] could be stretched to include electronic funds transfers,...but they were not in the contemplation of the draftsman."⁸ Thus it is unlikely that current law provides much guidance for wholesale wire transfer.

Professor Scott has pointed out several deficiencies of the current reliance on private contract (in the form of network rules) rather than statute.⁹ First, network rules do not cover the relationship between banks

⁵Penney and Baker (1980), chap. 10.

⁶See Scott (1983a), pp. 1676-8.

⁷See, e.g., Clarke (1969).

⁸Evra Corp. v. Swiss Bank Corp., 673 F.2d 951, 955 (7th Cir. 1982). See Miller and Harrell (1985), pp. 279-82.

⁹Scott (1983a), pp. 1674-6.

and their customers. While such relationships could be covered by private contracts, there is no evidence that such contracts are a common practice. Second, network rules specify relationships among bank participants but not between, say, receiving banks and sending customers in the event of a failure. Finally, it is not clear whether courts will enforce private contracts that do not operate within a well-defined statutory framework.

Recognizing the desirability of a codified body of electronic funds transfer law, the Permanent Editorial Board for the UCC initiated efforts in 1974 to revise Articles 3 and 4 to cover wire transfer along with other payment methods. This led to the Uniform New Payments Code, which was based on principles equally applicable to checks and wire transfers. The draft New Payments Code was submitted to the National Conference of Commissioners for Uniform State Laws in 1983, and was also discussed at a conference later that year. The response was not favorable. In 1985, it was decided to drop the New Payments Code. Instead, Articles 3 and 4 would be revised but still cover only checks. More significantly, a new Article (4A) would be added to cover wholesale wire transfer.¹⁰ The effort is now underway, and further consideration of the new article will take place in Summer 1988.

Professors Warren and Jordan, the Reporters preparing the draft articles, originally suggested that Article 4A be based on an underlying theory of wire transfer.¹¹ Specifically, they discussed two separate concepts of when payment by wire transfer should be considered final and irreversible by all parties. The first provides for receiver finality, that is, for payment to be

¹⁰Miller (1986). For an extensive discussion of how the UCC should be redrawn, see Leary and Fry (1984).

¹¹Warren and Jordan (1986), pp. 19-33.

final when the receiving bank accepts it. The second provides a system closer to payment by check, that is, payment is final when the receiving bank receives "good funds" from the sender. While receiver finality was preferred by some participants in the effort, it received withering criticism from others.¹² As a result, the preliminary draft submitted by the reporters abandoned any attempt to reflect an underlying theory of wire transfers in favor of a more pragmatic tack.¹³ Essentially, the new version provides one set of rules if everything functions normally, and another set effective only in the event of the failure of a bank to settle. If a failure occurs, the "skip rule" may take effect. This rule initiates a "bypass" of the failing bank in order to allow settlement to proceed.¹⁴

The reason given for abandoning the earlier "unified conceptual approach" based on an "underlying concept of the nature of a wire transfer" is that it "does not produce good results."¹⁵ Specifically, the reporters appear to wish to avoid imposing liability for huge wire transfers when the benefits to the banks of transmitting such amounts are actually rather small. In other words, banks may reconsider handling wholesale wire transfers at all if the expected liability is out of proportion to the revenue from handling the transfers.

Still, it seems premature to reject any attempt to base laws on an underlying concept of the nature of a wire transfer. Such a concept would

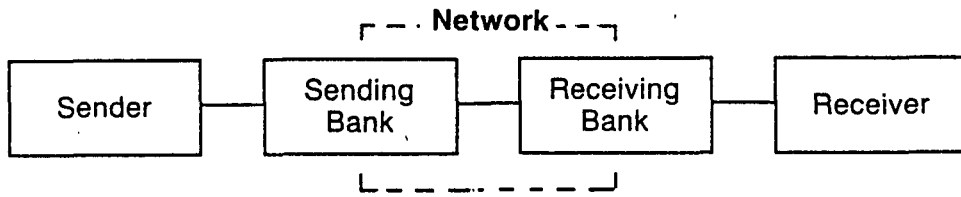
¹²Lee (1986).

¹³Jordan and Warren (1986).

¹⁴It should be emphasized that this is still a draft version of the Article. Even after the first reading before the Commissioners the new version may bear little resemblance to this latest version.

¹⁵Ibid, p. 2.

Figure 1
Hypothetical Wire Transfer Network



provide a coherent way of thinking that would be largely absent from a "pragmatic" approach. More important, a coherent framework would help to avoid contradictions in the development of legal rules. With such advantages in mind, the remainder of the paper will develop a hypothetical model of a wire transfer and then use the framework to explore various finality rules. The object is not only to determine the advantages and disadvantages of different finality rules, but also to decide whether such rules should be written into the law at all.

II. Analytical Framework

Consider a hypothetical wire transfer network consisting of four parties to each transaction. The network is diagrammed in Figure 1. The first is the customer who originates the transfer, and will be referred to here as the sender. The second is the depository institution used by the sender to transmit the payment message, here called the sending bank. The third is the bank receiving the transaction, and that bank is acting for the benefit of a customer. This is the receiving bank. Finally, the customer who is the beneficiary of the transfer is called the receiver. The transaction underlying each transfer is between the sender and receiver. It should also be noted that the sender and sending bank can be the same entity, as can the receiving bank and receiver.

As shown in the diagram, the network is formally comprised by its member banks. The banks transmit funds for the benefit of third parties, that is, senders and receivers. Their benefit from doing so is the fees received net of operating costs, along with the benefits associated with having custody of their customers' deposits.

Another assumption is that parties to a transaction can extend credit to those parties with whom they work directly. For example, sending banks can extend credit to senders, receiving banks to sending banks, and receiving banks to receivers. Stated another way, payments in the network are risky, that is, there is some probability that payments will not be covered. This probability leads to credit risk, the risk that loans will not be repaid.

Finally, payment between banks occurs periodically by means of net settlement. Under net settlement, each bank's obligations to and from the other banks are added up so only a net debit or credit amount is exchanged at the end of each settlement period.¹⁶ Net settlement means in effect that receiving banks extend credit to sending banks until settlement occurs.

In the hypothetical wire transfer network, there are several relationships in which credit risks arise. The most obvious is in the underlying transaction between the sender and receiver, since it is possible that the receiver will not receive the payment on the transaction. Such credit risk is not unique to payment networks, but rather is part of every transaction involving credit. Still, it is significant to payment network risk allocations because of the crucial question of when the underlying obligation is discharged.

The other risky relationships arise due to the presence of risky parties in the chain of transactors that comprises the network. The first such relationship is between the sender and sending bank. If the sender initiates a transfer with his sending bank but does not have sufficient funds in his account to cover the transfer, the sending bank incurs credit risk if it

¹⁶In contrast, gross settlement would involve actual exchange of funds between banks for each transaction.

transmits the payment message before the sender supplies the covering funds. Such risks are normally handled internally by banks as overdraft credit decisions.

The second relationship is between the sending bank and the receiving bank. The risk here is that the sending bank will fail to provide funds to the receiving bank at settlement.¹⁷ If the receiving bank has given irrevocable credit to the receiver, then the receiving bank could bear the loss.

Finally, the relationship between the receiving bank and receiver is risky for both parties. If the receiving bank allowed the receiver to draw on provisionally transferred funds before settlement, the result would depend on whether the receiving bank could successfully revoke the funds to cover its own loss. Thus, the receiver runs the risk of revocation, while the receiving bank runs the risk that it will not be able to retrieve funds from the receiver.

Credit risk, interdependence between banks, and the necessity that settlement take place at a given time give rise to another form of risk, namely, systemic risk. This refers to the expectation that a bank or banks will fail to settle due to another bank's failure to settle.¹⁸ Credit risk is essential to systemic risk because it determines the vulnerability of a bank to losses. Interdependence is important because a bank might depend on receipt of a large credit from one bank in order to meet its obligation to

¹⁷The relationship between the sender and sending bank is sometimes described as sender risk, and that between the sending bank and the receiving bank as receiver risk. See, e.g., Federal Reserve Bank of New York (1987-8), p. 7.

¹⁸For further discussion, see Mengle (1985), pp. 19-21.

another bank. Finally, the time constraint is important because if one bank fails to settle its net debit, other banks might face liquidity problems. That is, it might be very costly for them to find sufficient funds to meet their obligations in the time remaining before settlement.

As a real-world counterpart to the hypothetical model, on CHIPS systemic risk would be transmitted by means of a settlement "unwind."¹⁹ If a bank fails to settle, CHIPS Rule 13 provides that payment messages to and from the failed bank be deleted. If all goes well, a new settlement can go through minus the failed bank. But if the other banks are highly exposed to the failed bank as net creditors, they themselves may encounter severe liquidity problems. As a last resort, the rules apparently allow a complete unwind (or "return to storage") of the day's transactions, and the consequences of such a drastic revision in which some banks might walk away from settlement are unknown.

Measuring credit risk on a wire transfer network poses few conceptual problems. For each bank in a net credit position against another bank, its credit risk is approximated by its expected failure cost, that is, its net credit position with the other bank multiplied by the probability the other bank will fail to settle. To the extent that the costs of the settlement failure are borne by the receiving bank, credit risks represent a private cost to receiving banks who will take account of such costs in determining their exposure to sending banks.

¹⁹Lingl (1981) discusses the CHIPS rules and options for dealing with a settlement failure. For a simulated "worse case" scenario of a chain of settlement failures, see Humphrey (1986), pp. 100-11.

Systemic risk is conceptually more difficult to measure. While a receiving bank may be expected to take account of risks to itself as a net creditor, it has no incentive to take account of the risk it poses to other banks with which it has a net debit relationship. Thus the costs of a settlement failure go beyond the exposure of creditor banks to the failing bank. Rather, costs of a failure are equal to receiving banks' exposure plus other banks' exposure to the receiving banks. In other words, if as the result of one bank's failure to settle the receiving bank is also unable to settle, then the receiving bank's creditors will also bear costs. These latter costs, called externalities by economists, will not influence the receiving bank's exposure decisions but are borne nonetheless. It is these externalities that risk control policies are designed to reduce.

Risk control may be accomplished by either regulation or statute, and may seek to reduce risks by either confining them or by creating incentives to reduce them. An example of a regulation that seeks to confine risks is net debit caps. By limiting how much a bank may be in a net debit position with other banks, such a regulation attempts to circumscribe the amount by which the rest of the system is exposed to a bank. The main drawback to such regulation is that, while it may successfully limit risk, it does not reduce the incentives for banks to incur risks. As a result, banks have incentives to seek ways to evade caps through such means as offshore clearings if doing so is less costly than operating within the caps.

Measures that attempt to create incentives to reduce risks differ depending on the network. On Fedwire, pricing daylight overdrafts would create incentives to run lower overdraft levels while leaving banks the option

of incurring them.²⁰ On private net settlement networks, however, it is not clear how explicit pricing would be instituted. While daylight overdrafts are strictly speaking possible only on a gross settlement network like Fedwire, net debit positions are the analogous source of risk on a net settlement network. The analogy breaks down at this point because while it is possible to require that Fedwire transfers be fully funded so no overdrafts occur, a net settlement system could not function without at least one party running a net debit position. Thus, levying a fee on net debit positions would penalize behavior that cannot be fully avoided due to the nature of such a network. It is feasible, however, to impose a fee on CHIPS net debits that exceed reserve balances net of Fedwire daylight overdrafts. The problem is that monitoring and pricing two networks relative to reserve balances is likely to be a costly proposition.

III. Finality of Payment

As an alternative to explicit pricing of risk on net settlement networks, rules can be devised that allocate risks among parties to a transfer by specifying when a payment is considered irrevocable by each party. These rules, known as finality of payment rules, seek to reduce risks by influencing the incentives of the parties on whom risk are placed. In economic terms, they are designed to internalize the costs of settlement failure by assigning the costs to specific parties. In effect, because they specify with certainty on whom the costs of a settlement failure will fall, finality rules may be considered a form of implicit pricing of net settlement risk. If banks judge

²⁰Humphrey, Mengle, Ireland, and Morgenthaler (1987).

the price to be too high, they can reduce their risk exposure by means of tighter net credit limits or else bilateral arrangements to net payments outside the networks so actual transfers over the network are reduced.²¹

It should be noted here that finality rules do not by themselves represent responses to a "market failure." Rather, such rules specify rights and obligations of the parties to a transaction and thereby shape the environment within which the market functions. In other words, finality rules do not attempt to substitute for the market, but rather to establish risk allocations within the market and thereby enable transactors to determine what the costs of their decisions are likely to be. While it is true that finality rules could be administratively imposed as regulations, they do not limit transactors' choices. They simply specify who bears the risk of a choice and let people act on the basis of that knowledge. In contrast, net debit caps explicitly and directly limit transactors' options.

Given that finality of payment rules could reduce risks, why have they not been voluntarily adopted? One reason may be that such rules would only apply to a highly unlikely situation, namely, settlement failure. Because a failure is unlikely and has not in fact happened, network participants may feel little urgency in preparing for such an emergency. Rather, they may prefer to handle such contingencies when and where they occur.²²

There is another factor that could discourage adoption of finality rules. Suppose network participants expect that in the event of a settlement failure they will be relieved of risks. For example, payments could be

²¹See Mengle, Humphrey, and Summers (1987), pp. 8-9.

²²Scott (1983a), pp. 1675-6.

guaranteed, either explicitly or implicitly, by an insurer, central bank, or other party outside the network. If network participants expect to be so relieved, they will have little reason as individual institutions to limit their own risk exposures or as a group to adopt rules which limit or assign risks.

IV. Which Finality Rule?

Criteria In traditional economic analysis of regulation, the choice often presented is between an unregulated market outcome and a regulated outcome. A more detailed analysis might present several alternative regulatory scenarios. Here, there is no such neat dichotomy. Instead, there is the regulatory solution, which most likely would take the form of administratively imposed limits on net debit positions of network participants; and then there is a set of market solutions under various finality of payment rules. Even if no rule is imposed by regulators or law or adopted by collective decision, there will still be an implicit finality rule. In fact, one would expect the implicit rule to eventually find its way into case law and become an explicit rule.

The objective of the analysis of finality rules will be to determine which alternative creates the strongest incentives to minimize the costs due to settlement failure. No alternative will be ideal, and each will create some incentives which will work at cross-purposes with one another. Still, it is possible to express judgments about the relative strengths of the incentives to monitor banks, to shift costs to others, and to otherwise evade the requirements of the finality rule to regulation.

Various criteria for evaluating laws and regulations have been proposed in the economics literature. Guido Calabresi (1970) has outlined two

approaches. The first is loss spreading, which seeks to minimize costs to each party by spreading losses as widely as possible. The second is to assign losses to the "cheapest-cost avoider" of whatever causes the losses, and thereby minimize the chance of the loss occurring. For example, a driver running into a car in front of him is normally presumed to be at fault because he is generally in the position to avoid the accident at lower cost than is the driver in front.²³ Robert D. Cooter and Edward L. Rubin (1987) call this latter criterion the "loss reduction principle," which assigns liability to whoever can reduce losses at lowest cost. They express the distinction nicely: "Loss spreading presumes that a loss has already occurred and assigns liability to the party that can more effectively spread it, but the loss reduction principle assigns liability for the more complex purpose of affecting human behavior."²⁴ Thus, finality rules can be evaluated both on how effectively they spread losses and how effectively they could modify behavior.

While loss spreading is fairly straightforward, the cheapest-cost avoider principle requires determining which party fits the description. This involves at least four considerations.²⁵ First, and most obvious, the cheapest-cost avoider must actually be able to take some action that will minimize losses. If the party selected cannot control its exposure, then the liability assignment amounts to no more than a search for "deep pockets." Second, the costs of avoidance must be considered in relation to the value of

²³See Demsetz (1972).

²⁴Cooter and Rubin (1987), p. 73.

²⁵Calabresi (1970), pp. 140-52.

the activity in which the potential victim is involved. That is, if the cheapest-cost avoider will only exercise care by either ceasing or drastically reducing a valued activity, then it may be preferable to either spread the losses or else find a somewhat more expensive avoider. In Professor Calabresi's words, it might be advisable

"to exclude from consideration as potential loss bearers all those activities that could reduce costs only by causing losses which are clearly much greater, in terms of meeting individuals' desires as expressed in the market, than would result if one achieved the equivalent or greater reduction in accident costs by burdening other activities."²⁶

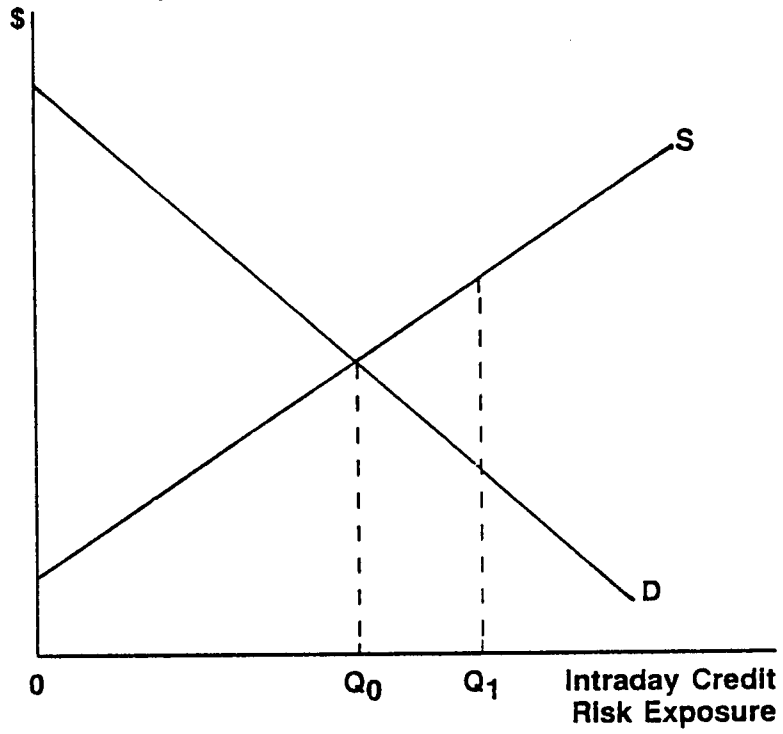
Third, assigning liability to the cheapest-cost avoider must bring about internalization of losses. In other words, the costs must actually be borne by the cheapest-cost avoider in order to induce him to avoid the costs. This means that the party selected should not be able to cheaply avoid the losses by shifting them to another party. Finally, even if it is not clear who the cheapest-cost avoider is, one can assign losses to the party best able to determine the cheapest-cost avoider and to contract with it.

Assigning losses to the cheapest-cost avoider should lead to minimum costs as shown in the simple supply and demand diagram in Figure 2.²⁷ The demand curve (D) represents the benefits of an additional dollar of intraday credit risk exposure to a particular party to a transaction. As is generally the case in economic analysis, the curve is assumed to slope downward because each additional dollar of credit risk exposure is likely to be assigned to a less valuable use than was the previous dollar. The supply curve (S)

²⁶Ibid, p. 141.

²⁷This framework is developed in more detail in Mengle, Humphrey, and Summers (1987).

Figure 2
Determination of Risk Exposure
by the Cheapest-Cost AVOIDER



represents the expected cost of settlement failure, and slopes upward because failure costs are assumed to increase with exposure. The potential victim compares the expected costs of settlement failure with the benefits of the credit risk in determining its exposure to a particular party.

Assume a receiving bank's risk exposure in Figure 2 is Q_1 . At that level, the benefit of the last dollar of risk exposure would be less than the cost. As a result, the bank would have a reason to cut back its exposure. So long as the benefit given up by reducing exposure is less than the avoided failure cost, there is incentive to reduce exposure. At some level of exposure (Q_0), however, expected failure costs will decline below what is given up in benefits, and it no longer pays to reduce exposure. At this level, total costs are minimized.

The notion of a cheapest-cost avoider has not gone uncriticized. John Prather Brown (1973) points out that the concept is of limited value because it assumes that only one party should be expected to exercise care. In other words, it compares the costs of avoidance of each party assuming that the others make no attempt at avoidance. According to Brown, this leaves out intermediate liability assignments that would induce the optimal amount of avoidance from all parties concerned. The problem with this criticism is that, while an ideal rule might seek to get each party to contribute its share of avoidance, developing such a rule would require a great deal of information regarding relative costs of avoidance among the parties. That is, rather than identifying just the cheapest-cost avoider, one would have to rank each party according to comparative advantage in avoidance and determine relative liabilities consistent with the ranking. Another problem is that assigning liabilities to more than one party would involve a more complex rule and thereby create more potential for costly litigation if a failure did occur.

Assumptions The analysis of finality rules that follows makes four assumptions within the context of the hypothetical payment network described in Section III. First, network participants are assumed to have access at low cost to accurate information regarding the risks of other participants in the network. Second, no regulatory body, central bank, or other outside party will intervene to aid any network participants after settlement failure occurs. Third, when failure occurs only the net obligations to and from the failed bank are relevant. This ignores the possibility that, in bankruptcy, banks might be held to their gross obligations to the failed bank. Finally, settlement failure occurs exogenously. This means there is no action any participant can take to influence the probability of a settlement failure.

The last assumption points out the difference between the economic analysis of finality rules and that of other areas of law. First, while the preceding discussion strongly suggests analogies between tort law and payment law, the assumption here of exogenous settlement failure rules out the possibility of designing a rule that will directly attempt to make failure less likely. In other words, in payment law there is no counterpart to assigning tort liability to the injurer in order to influence his behavior. The injurer could, however, be required to post a bond, post collateral, or otherwise guarantee in advance against losses to others. By imposing liability on a firm's creditors or guarantors, there may be incentives for these latter parties to attempt to reduce the probability of failure. The point is that no rule directly influences the failing bank, but rather attempts to induce other parties to act to protect themselves.

Second, the externality element in systemic risk implies similarity to environmental law. Again, because the ability to influence the probability of failure is ruled out by assumption, most of the rules to be evaluated are

designed to influence the victims' or guarantors' behavior or costs. That is, externalities cannot be internalized by the injurer, but only by the victims or guarantors in the form of protective behavior.

The remainder of the section will consider various finality rules in the light of the concepts of risk spreading and risk avoidance.

Check Finality²⁸ Consider a rule that states that the sender's obligation to the receiver is finally paid when the receiver has access to "good funds." Another way of saying this is that the sender's obligation on the underlying transaction is not discharged until the payment between the banks in the network is finally settled, for example, by credit to the receiving bank's Federal Reserve Bank account.

The rule is called "check" finality here because it resembles the current rule for when a payment by check becomes final. For example, Section 4-213(1) of the UCC provides that payment by the payor bank is final if (1) the payor bank has paid the check in cash, (2) finally settled without reserving the right to revoke, (3) posted the item to the payor's account, or, most commonly, (4) failed to revoke the provisional settlement before the deadline for such revocation. Further, Section 4-213(4) gives the payee the right to draw on collected funds after his bank has received final settlement and has had "reasonable" time to verify that settlement was indeed final. This affords the payee's bank a means of protecting itself by debiting the payee's account if the check bounces. Finally, Section 3-802 discharges the payor on the underlying obligation when the check is paid by his bank.

²⁸This alternative is based on the "good funds" theory of wire transfer described by Warren and Jordan (1986), pp. 19-20, 27-32.

The analogous rule for a wholesale credit transfer is to make the receiving bank liable to the receiver for the amount of the transfer once the receiving bank has received final settlement from the sending bank. The underlying obligation between sender and receiver would also be discharged once the receiving bank obtains final settlement.

So who bears the cost if a sending bank fails? The receiving bank is not obligated to release funds to the receiver before final settlement. Unless the receiving bank had already granted irrevocable credit prior to settlement, it will have the right to debit the amount of the transfer to the receiver's account. Thus the underlying obligation remains unsatisfied so the receiver has a claim against the sender. But the sender may have already provided funds to his bank which has since failed. In this case, the sender appears to end up bearing the risk of his choice of sending banks.

If it is the sender who bears the risk, one must ask whether the sender meets the criteria for cheapest-cost avoider or most effective risk spreader. In wholesale wire transfer, the sender is most likely a corporation, possibly a bank. Given the size of the transfers, it is plausible that senders are of sufficient sophistication to monitor the soundness of the banks with which they do business. Failure of a sending bank is something against which a prudent sender can protect himself.

The risk assignment breaks down, however, if the sender's bank is not a network participant but enters the network through a correspondent that is. It is possible that the correspondent sending bank might fail, and even the most sophisticated sender would not choose and probably would not even know which banks stand between his bank and the sending bank on the network. To find out such information would in fact be costly for the sender. Thus it is not likely that the sender meets the first criterion for cheapest cost

avoider, that is, he is not necessarily in a position to take some action to minimize losses.

The sender also may not meet the criteria for cheapest-cost avoider because he may be able to evade the costs of a settlement failure and pass them on to other parties. Specifically, even if the receiver has a claim against the sender on the underlying transaction, it is possible that he will not recover without protracted and costly litigation. Further, it is also possible that, if the receiving bank had provisionally released funds to the receiver before settlement, the receiving bank may not successfully recover the funds from the receiver. Thus, while the incidence of losses in check finality may nominally be on the sender, actual incidence is ambiguous. And since it is not clear who will bear the cost, it is not clear that the check finality rule will be effective at modifying behavior to reduce losses.

While check finality might not be an effective rule from the standpoint of the cheapest-cost avoider principle, the very ambiguity of the risk allocation might make it effective as a means of risk spreading. Even if the rule would not reduce risk avoidance in any one party, it might reduce risks to individual banks by distributing the risks among the parties to a transaction. The problem is, since there is no rule for spreading the risk, the risk might be spread among the parties only on the basis of ability to evade the costs. This means that the risk would be spread in an unpredictable manner and possibly would be concentrated on one party. So while it is conceivable that the check finality rule would be an effective risk spreading rule, it is by no means certain.

Settlement Finality I (ex ante) Settlement finality rules make settlement entries between banks irreversible. If a sending bank fails to settle, some bank or group of banks is required to provide funds to allow

settlement to go through. Whether the final incidence of the costs remains with the banks depends on the rule chosen.

Ex ante settlement finality would in essence have the failing bank guarantee settlement in advance by posting sufficient collateral to cover its net debit with the network. This is equivalent to a performance bond posted by the bank. As long as no failure occurs, the bank earns a return on the collateral. If the bank fails, then it forfeits the collateral.²⁹

By its nature, ex ante settlement finality makes no attempt to assign risks to the cheapest-cost avoider. Rather, it simply seeks to ensure that settlement will go through in the event of failure so credit risks are covered and systemic risk is eliminated. The rule is actually a risk spreading rule since the credit risks are transferred outside the network to the deposit insurance funds and unsecured creditors. The more collateral used to cover the net debit, the less available to parties with a claim to the assets of the failed bank.

Credit risks in the system would probably not be affected by the ex ante rule because no costs would be borne by banks in the network other than the failing bank. That is, collateralization of sending bank net debits would not affect the incentives of other banks to control their exposure to the failing bank.³⁰ But while the sum of risks in the system might remain the same, the element of interdependence would be broken so systemic risk is not a consideration. Thus, ex ante settlement finality would be effective for

²⁹Corrigan's (1987) proposed "liquidity balance" requirement for wire transfer networks is essentially a form of ex ante settlement finality.

³⁰But it could affect the incentives of unsecured creditors or guarantors to reduce the likelihood of a failure to settle.

eliminating the risk of a chain of settlement failures, but would not directly reduce expected losses from a settlement failure. It would merely shift them.

Settlement Finality II (ex post) An ex post finality rule allocates the losses from a failure to a bank or banks after a failure occurs. This first version of an ex post settlement finality rule would divide up the costs among all the banks in the network (except the failed bank) either equally, according to network usage, or by some other criterion unrelated to exposure. Because all are required to come up with funds to complete settlement, the risk of failure is initially assigned to network banks. Since nothing in such a rule prevents banks that are creditors of the failed bank from attempting to charge back funds provisionally released to receivers, however, some of the risk could ultimately be borne by receivers.

Because the rule attempts to reduce the ability to shift costs by means of a settlement unwind, it creates incentives for banks to monitor sending banks and therefore to reduce credit risks. If the option of an unwind can be eliminated, for example by requiring each bank to post collateral sufficient to cover its highest net bilateral credit limit with another bank, incentives to monitor will be stronger. Further, the rule should lead to a reduction but not elimination of systemic risk. While the incentives to monitor should make a settlement failure less likely to disrupt the network, there is still some chance that the remaining risk exposure could threaten some secondary failures.

The major disadvantage of the rule is that it does not allocate risk according to exposure, and therefore would have limited effects on behavior of receiving banks. Banks would have some incentives to monitor sending banks because they will wish to avoid the costs of failure, but the incentives are weaker than they would be if costs were related to exposure. An externality

effect is present here because some banks may take on greater exposure in the knowledge that the costs of failure would be spread among all the banks in the network. Thus credit and systemic risk are not reduced as much as would be the case under a rule more sensitive to actual exposure.

While the rule does not create strong incentives to monitor risks, it does tend to spread risks among the network participants. More important, so long as the risk spreading criterion were known in advance, risks would be spread in a predictable and roughly equitable manner. Thus, if one were to conclude that risk spreading was the preferred criterion for a rule, this type of settlement finality rule would be superior to check finality.

Settlement Finality III (ex post) This rule allocates costs of failure among receiving (creditor) banks on the basis of their exposure to the failing bank. For example, costs could be divided among banks on the basis of their net credit positions against the failed bank at the time of failure. Alternatively, losses could be allocated on the basis of banks' net credit limits with the failed bank at the time of failure. While the former is based on actual exposure and the latter on willingness to take on exposure, both would have similar incentives for receiving banks to monitor the creditworthiness of the banks from which they accept transfers.

Of all the parties to a wire transfer, the receiving bank is in the position to monitor the soundness of other banks at the lowest cost. Also, the receiving bank is in a position to refuse to accept a wire transfer if it suspects the sending bank will fail to settle. Finally, because the rule allows funds to be revoked from receivers, the rule allows risks to be shifted to receivers and ultimately, perhaps, to senders. In that the allocation of risks among receiving banks and their receiving customers is a matter that could be determined by private contract, the last consideration is consistent

with the characterization of the cheapest-cost avoider as the party best able to contract with others to bear the risk. To the extent that receiving banks bear costs under an ex post finality rule, then, the rule does seek out the cheapest-cost avoider.

This rule has most of the advantages but not the disadvantages of the previous ex post settlement rule. That is, it restricts the option of a settlement unwind and motivates receiving banks to monitor banks for whom they are net creditors. But because it allocates costs on the basis of exposure, it creates stronger monitoring incentives and therefore makes the possibility of a disruptive settlement failure less likely. If risk spreading is preferred as a criterion to risk reduction, however, using exposure to assign risks will not spread risk as widely as in the previous settlement finality rule.

Receiver Finality This last rule makes settlement irreversible and also requires that receivers be granted irrevocable credit when a payment message is accepted. In other words, there is no recourse to the receiver. Thus, risks are concentrated on the receiving bank.

A way in which a receiver finality rule could be implemented is to provide that when a receiving bank accepts a transfer it becomes liable to the receiver for the amount of the transfer. Further, when the receiving bank accepts the transfer the sender's obligation to the receiver on the underlying transaction is discharged.³¹ The principle is that the receiving bank's acceptance of the transfer is the determining event in establishing liability,

³¹Warren and Jordan (1986), pp. 21-25.

and it is the receiving bank that is in the best position to determine the soundness of the sending bank.

As the cheapest-cost avoider with no ability to shift costs, the receiving bank would have far stronger incentives to monitor the soundness of other banks than would be the case in any of the other alternatives. The only obvious way costs could be shifted to others would be in transaction fees. Thus, the internalization of losses would be most complete under receiver finality. From the standpoint of behavior modification, then, receiver finality represents the most promising rule since "receiving banks may be forced to examine the creditworthiness of each and every incoming payment."³² In addition, it would provide the most certainty of how risks would be allocated if a settlement failure were to occur. Finally, because it does give banks incentives to monitor and thereby reduce credit risk, receiver finality should reduce systemic risk.

The major disadvantage of receiver finality derives from the substantial potential liability it imposes on receiving banks.³³ It is possible that banks might judge their expected costs from receiver finality to be greater than their expected benefits from handling net settlement network transactions. If this is the case, banks may cease participating in the network at all or else do so only at fees higher than the value of the service to their customers. While this would mean lower risks, it would also mean less of a valued service. Thus while the receiving bank may appear to be the

³²Lee (1986), p. 2.

³³Ibid, p. 7.

cheapest-cost avoider at first blush, a full consideration of the costs of receiver finality might tell otherwise.

Criticism of receiver finality may be expressed in terms of a model developed by Professor Baxter (1983). In this model, both the benefits and costs to the parties to a network transaction are incurred jointly. This means that the benefits of a transaction are equal to the sum of the benefits to all the parties to the transaction, and similarly that the costs are the sum of costs to all parties. Assuming that the benefits of the transaction to each party are roughly equal, placing a disproportionate share of the costs on the receiving bank might make it unwilling to carry the transaction unless it could bargain or contract with the other parties to share the costs. If bargaining is not feasible and the receiving bank refuses to handle the transfer, the transfer will not take place. In contrast, had the risks been spread among the transactors, the costs to any one party would more likely be less than the benefits so the service would remain worthwhile for all parties.

Another objection to receiver finality is that it increases risk to individual banks and therefore might increase rather than decrease systemic risk.³⁴ That is, by placing all the risks on the receiving bank it becomes more likely that the receiving bank could fail if a sending bank defaulted.

Defenders of receiver finality might answer in two ways. First, the critics of receiver finality assume no behavior change among network participants. In other words, they assume that under receiver finality receiving banks will be fully responsible for the same level of failure costs as would have prevailed in the absence of receiver finality. But risk is in

³⁴Association of Reserve City Bankers (1985), pp. 18-19.

part a function of monitoring by receiving banks. If receiver finality makes banks pay more attention to banks from whom they accept transfers, risk will fall and expected costs will be lower since the receiving bank will be in a position to avoid the losses. While transaction volume might be somewhat lower, it should not fall to zero since banks will balance monitoring costs against avoided failure costs at the margin.

A second answer to the criticism involves a thornier issue. The contention that banks will abandon net settlement networks in response to receiver finality and thereby deprive the public of a valued service assumes there are no substitutes available. This is not the case, since Fedwire would still be available. But as has been pointed out by the Department of Justice, Fedwire provides without extra charge receiver finality while guaranteeing against settlement failure.³⁵ Thus if receiver finality were to be considered for imposition by regulation, competitive equity might demand that pricing of Fedwire daylight overdrafts be considered at the same time. This also calls into question the appropriateness of codifying receiver finality into the law, since it might put the UCC into the position of favoring one network over the other.³⁶

Summary A comparison of the effects of finality rules is shown in Table 1 under the assumptions outlined above. Each finality rule is ranked according to its ability to influence behavior, to spread risks, to increase

³⁵U.S. Department of Justice (1984), pp. 34-5. The same considerations apply to ex post settlement finality rules but not, interestingly, to ex ante net debit collateralization.

³⁶At least in the case of the Uniform New Payments Code, a specific guiding principle was that the law "should not distort user choices among different payment systems..." Scott (1983b), p. 1.

Table 1
SUMMARY OF THE EFFECTS OF FINALITY RULES

	Check Finality	Settlement Finality			Receiver Finality
		I Ex Ante Sender Collateralization	II Ex post Risks on Network	III Ex Post Risks on Creditors	
Encourages Risk Reduction	Low	Least	Moderate	High	Most
Spreads Risk	Unclear, but possibly high	To deposit insurance funds and unsecured creditors	High	Moderate	Least
Risk to Individual Banks (Potential liability)	Unclear, but possibly low	Least	Moderate	High	Most
Systemic Risk	Most	None	Moderate	Low	Least

risks to individual depository institutions, and for its effect on systemic risk. As can be seen, the choice is ambiguous and would require a weighting of each characteristic. If one placed great weight on risk spreading, for example, then check finality or Settlement Finality II might be preferred, while a high weight on behavior modification would shift the balance toward receiver finality.

V. Qualifications to Finality Rules

Thus far the analysis of finality rules has assumed inter alia that banks have accurate information regarding the risks of other banks on their network and that there is no intervention by parties outside the network. This section analyses the effect of dropping each of the two assumptions.

Changing Informational Assumptions As of this writing, a settlement failure on a large-dollar wire transfer network has never occurred. It is safe to say that the probability of one occurring, while finite, is exceedingly low. Yet if a settlement failure does take place, the costs could be enormous.³⁷ Analysis of such a low probability, high cost event suggests analogies with the economics of insurance against natural disasters.

For insurance against most losses, individuals purchase insurance on the basis of their estimate of expected losses. The expected losses are in turn the product of the probability of a loss occurring and the loss itself. In such areas as mortality, automobile accidents, and most other losses, the probabilities can be determined from actuarial data and the losses judged from experience.

³⁷See Humphrey (1986).

In contrast, there is far less experience with disasters such as earthquakes or toxic spills from which to compute probabilities or actual losses. The situation is even worse for settlement failure since there is no experience on which to base probabilities. Even subjective probability assessments are likely to be arbitrary, although it is conceivable that various "expert" judgments of probabilities could be combined into a consensus value.³⁸

In the literature on low probability, high cost events, there is a general finding that people misperceive risks in such cases.³⁹ Specifically, because the probability is so low, people appear to treat it as insignificant. The result is little interest in either insurance protection or other measures to lessen risk.

One explanation for systematic misperception of risks may be found in work by cognitive psychologists. Tversky and Kahneman (1974) have described various intuitive decision processes, known as heuristics, which people use in actual decisions. While such devices are useful as means of economizing on information and processing costs, they also can lead to systematic biases. One heuristic, availability, has people judge probabilities of events according to the ease with which examples come to mind. This implies that rare events such as settlement failures are not easily imagined and as a result are not considered likely. While the event in question is already a low probability event, availability tends to bias individuals' estimates still

³⁸Sampson and Smith (1982).

³⁹See, for example, Kunreuther et al. (1978). In a banking and finance context, Guttentag and Herring (1986) refer to this tendency as "disaster myopia."

farther downward. Another heuristic, described by Slovic et al. (1977), has people ignore losses if the subjective probability estimate of their occurring is below a certain threshold. As with availability, the justification for this heuristic is economizing on information and processing costs, and the result of course is to further underestimate risks. Finally, Tversky and Kahneman (1986) point out that systematic errors can occur when facing unique situations because there is no opportunity for feedback or learning.

If there is validity to the psychologists' contentions regarding low probability high cost risks, then there may be reason to question the efficacy of most of the finality rules described above. More important, the more a rule concentrates risk on the cheapest-cost avoider, the more critical accurate risk perceptions become. If risk perceptions are expected to be systematically biased downward, then, finality rules will not have the hoped-for behavior modification effects.

In order to determine the effect of alternative assumptions regarding risk perceptions, assume that network participants systemically underestimate the risks of settlement failure. The resulting unreliability of risk assessments would affect receiver finality and the two ex post settlement finality options, but would have little effect on check finality or ex ante sender collateralization. Specifically, since receiving banks underestimate settlement failure probabilities, they do not engage in sufficient monitoring and do not reduce risks. Moreover, nothing increases the ability of these rules to spread risks. Thus, while risk is concentrated on either receiving banks or receiving banks and receivers, little happens to reduce risks. The result is that under risk misperception receiver finality could increase systemic risk.

Two alternatives are not greatly affected by risk misperception. For check finality, the uncertainty of the risk allocations and the rough potential for risk spreading remain the same as under the assumption of accurate risk perceptions. Similarly, ex ante sender collateralization would have the same effects under accurate or inaccurate perceptions since it is simply a risk spreading rule.

Thus, a tendency to underestimate risks of settlement failure would argue against any rule that attempts to create incentives for banks to reduce risks. Because both receiver finality and ex post settlement finality rules depend on accurate information, the preferred alternatives could be narrowed. If the uncertainty of check finality risk allocations lead to rejection of this alternative, then either ex ante sender collateralization, more stringent net debit caps, or any other alternative that does not require accurate risk assessments by network participants might be preferred to a finality rule that attempts to elicit monitoring from a cheapest-cost avoider.

There are at least four possible objections to considering the role of risk misperceptions. First, it may be objected that it attributes irrationality to people because they systematically fail to take account of information that it would be to their benefit to use. But in ignoring rare events people may be acting rationally by economizing on information they do not expect to use. Second, one may point out that assuming risk misperceptions is purely a short run problem since learning will take care of the misperceptions once a settlement failure occurs or almost occurs. This may well be true, but the question remains of whether one wishes to wait for such a failure or, as a matter of policy, attempt to avoid such a disaster before it occurs.

A third objection is more difficult to answer. It is possible that risk misperceptions are a function of the low level of monitoring under current ambiguous risk assignments. That is, no party to a transaction now has incentives to incur the costs of developing reliable assessments of failure probabilities. Once receiver finality is instituted, however, the concentration of risks on receiving banks will give them incentives to form more accurate risk estimates and act accordingly. Unfortunately, this is an empirical matter that could only be answered after observing behavior after adopting receiver finality. Perhaps monitoring would increase after risks were assigned to receiving banks, but it is also possible that misperceptions would continue as before. This is a chicken-egg question which one cannot answer a priori.

A final objection to the idea of misperceptions is that they could just as easily lead to overestimates of risk as to underestimates. This possibility has been noted by Slovic, Fischhoff, and Lichtenstein (1982), who point to the effect of a movie like The China Syndrome on perceptions of nuclear power or of Jaws on swimming. Once a disaster becomes readily imaginable, the availability heuristic causes an upward bias to probability estimates. While it is unlikely that Hollywood will come out with a movie dramatizing the effects of a settlement failure, it is possible that concentrating on worst-case scenarios such as in Humphrey (1986) without consideration of the plausibility of the assumptions on which such simulations are based could lead network participants to exaggerate the dangers involved. The answer to the objection depends on one's policy objectives. If the overriding aim is to avert the ill effects of a settlement failure, then there is little to fear from overestimates of risk. It must be conceded, however,

that from an efficiency standpoint overestimates have little to recommend themselves over underestimates.

Settlement Failure Resolution Policy Even if one accepts the informational assumptions necessary for the effectiveness of ex post finality rules, there is a more serious problem likely to undermine such rules under current policies. The problem is the following. If in the event of a settlement failure regulators were expected to act to allow settlement by "bailing out" the failing bank, then neither receiver nor settlement finality would affect overall risk. That is, if banks do not expect they will actually bear the costs allocated to them by a finality rule, they have little reason to take the rule seriously.

If a bank does fail to settle, a bailout could occur in various ways.⁴⁰ For example, the bank itself might be rescued from failure. Alternatively, a line of credit could be made available. Finally, a discount window loan could be made to allow settlement to proceed. In all the examples, a party outside the network assumed the costs of the failure and relieved network participants of the risk.

Expectation of a bailout would lead to a moral hazard on the network, that is, a willingness for banks to take extra risks in the knowledge that they will be relieved of the costs if a failure does occur. The result would be a higher degree of credit risk. But at the same time, systemic risk would be eliminated since the failure costs would be intercepted by the outside party rather than passed on to network participants. Thus the risk allocation resulting from bailing out a settlement failure is similar to that of ex ante

⁴⁰For further discussion of how the Federal Reserve might handle a settlement failure, see Dudley (1986).

sender collateralization. In neither case do receiving banks bear risks. The disadvantage is that there are only weak incentives for receiving banks to monitor risks. Consequently the outside party bears more risk. The advantage, however, is that the potentially severe consequences of a settlement failure are averted, and that may be the paramount consideration in the minds of regulators.

The overriding concern for systemic stability may be seen in a recent Canadian bank failure. When Northland Bank failed in 1985, the Bank of Canada assumed the settlement risk by means of a \$30 million "extraordinary entry" to Northland, which is the equivalent of a discount window advance. This relieved Northland's clearer of the risk, and was done under the belief that a clearing bank "should not be placed in a position of jeopardy on account of payments initiated by that other financial institution from an account at the Bank of Canada."⁴¹ In other words, there was a conscious decision that the integrity of the payment system demanded that the clearing bank should not have to bear the risk. While such a bailout may not be an attractive option, the alternative might be even less attractive.

It should be emphasized that discount window loans or bank lines of credit in connection with a settlement failure do not always lead to a moral hazard. Suppose that instead of making funds available to the bank failing to settle, credit were extended to receiving banks experiencing liquidity problems. That is, lending is only to solvent banks. Since the borrowing banks are obligated to repay the loan at interest and thereby absorb the risk, the risk allocations of ex post finality rules would be imposed as intended.

⁴¹Bank of Canada (1985).

Such a loan would eliminate systemic risk by keeping liquidity problems from being transmitted from one bank to another, but would not relieve banks of the credit risks.

Thus if network participants know that all lending in response to a settlement failure would go to allay liquidity problems rather than to the failing bank, they will have reason to take account of the risk allocations in a finality rule. The problem is, given current government involvement in bank failures, is there a credible way to make a finality rule? The obstacle to be overcome is convincing network participants that they will be required to bear the risks specified in a rule if a settlement failure actually occurs. There are at least two reasons such credibility might be hard to achieve.

The first is the belief that certain banks are "too big to fail." Particularly after the Continental Illinois rescue in 1984, it is safe to say that there is some doubt as to the willingness of federal authorities to let a major bank fail. This belief has been more recently reinforced by the current experience with First Republic Bank Corp. and First City Bancorporation in Texas. While there is no analogous experience with a major participant in CHIPS, the reluctance of officials to sit back and watch while a failure causes a major disruption is understandable. While the Northland Bank example cited above occurred in another country, the incentives of the regulators may be similar across countries.

A second problem is more general. Settlement failure policies are subject to the problem of making a credible commitment to enforce the cost allocations in ex post finality rules.⁴² Given, say, a receiver finality

⁴²This phenomenon has been called time inconsistency in the economic policy literature. See Taylor (1985) for a nontechnical explanation.

rule, policymakers will declare that receiving banks will bear the costs if a settlement failure occurs. But if the failure actually does occur, there is the danger that receiving banks will be threatened by such severe liquidity problems that their own survival is threatened. At this point, the choice is between bailing out the bank failing to settle or letting the receiving banks fail along with the sending bank. Of the two unpleasant choices, the bailout is the less disruptive. But network participants know that authorities would choose a bailout if the only alternative were a chain of settlement failures, so they have little incentive to monitor risks before the failure occurs. Thus they do little to control their risk exposures.

A simple example may help to illustrate the decision process involved. Assume a bank can earn profits equal to 10 from participating in a network. A settlement failure would wipe that entire amount out. If, however, the bank decides to monitor risks more carefully, the monitoring cost (including foregone income) is 2 but the losses from settlement failure are reduced from 10 to 5. Table 2 summarizes the possible outcomes assuming no bailout. Regulatory authorities hope that their policies will induce banks to employ a "maximin" strategy. That is, they would like banks to choose to limit risks in order to avoid the worst possible outcome which is complete ruin.

But banks see matters differently as shown in Table 3. Banks forego income by limiting risks. And they know regulators have the option of a bailout that would insulate banks from losses. So if a settlement failure occurs, regulators have to choose between a bailout and no bailout whether or not banks previously chose to limit risks. So when failure occurs, regulators themselves end up pursuing the maximin course. In other words, they choose the bailout to avoid the worst possible consequence, namely, the settlement failure that wipes the banks out.

Table 2
Bank Choices as Seen by Regulators

	Failure Occurs	No Failure Occurs
Banks limit risks	3	8
Banks do not limit risks	0	10

Table 3
Bank and Regulator Choices as Seen by Banks

	Bailout	No Bailout
Banks limit risks	8	3
Banks do not limit risks	10	0

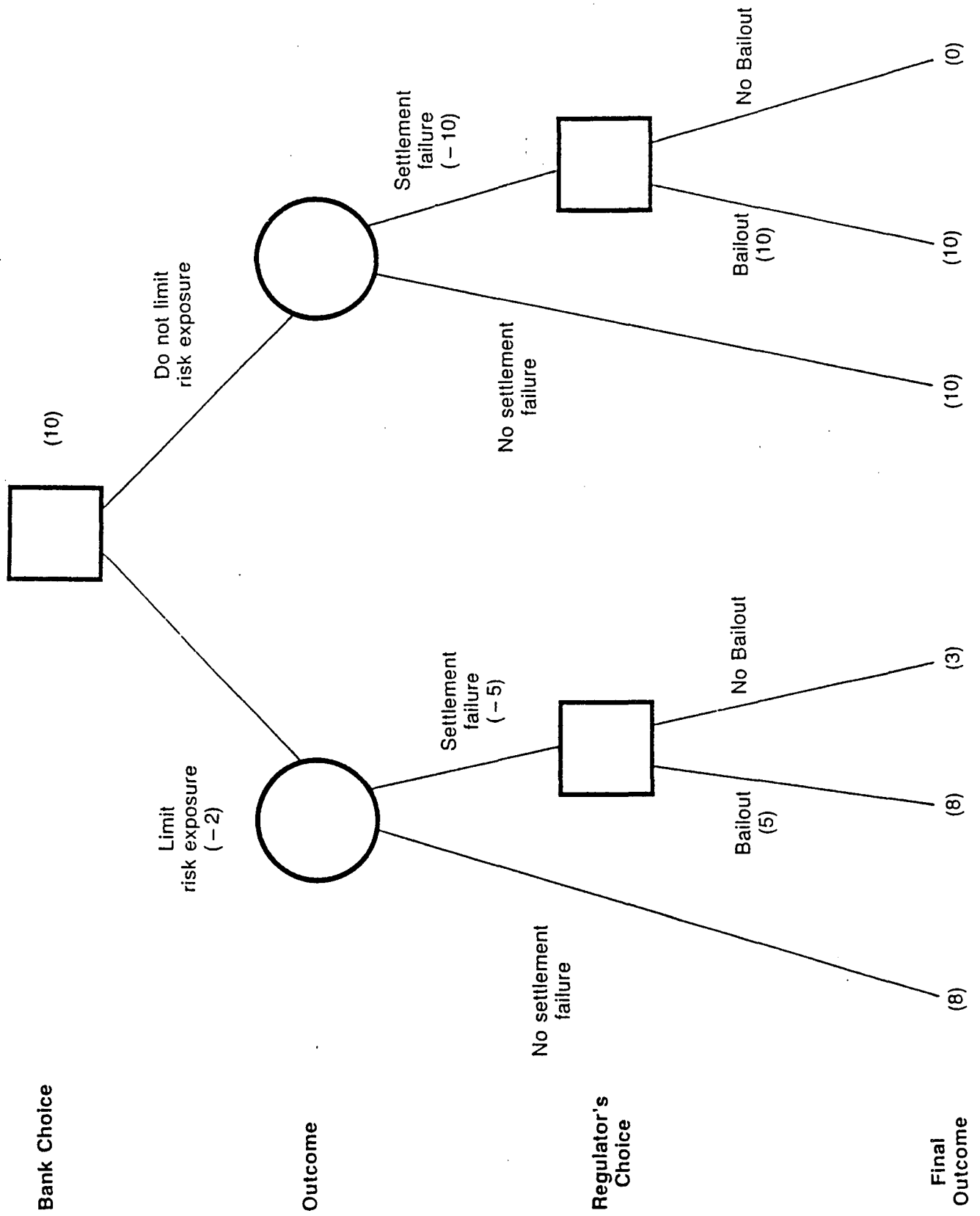
The full decision process is diagrammed in Figure 3. Regulators (or the legislature) adopt an ex post finality rule with the aim of influencing the behavior of network participants. But the participants know that the actual sequence of decisions and events will proceed as in the diagram. First, the banks choose to limit or not to limit risks. Second, a settlement failure either occurs or does not. Third, if a failure occurs the authorities decide whether or not to bail it out. For banks, the best and worse outcomes are possible if they choose not to limit risks, but the best is far more probable. More important, they anticipate that regulators will choose a bailout in order to avoid the worst outcome. This is true even if regulators attempt to deny they will go for a bailout if settlement does fail. The result is more risk in the system because of implicit "insurance" of settlement by regulatory authorities.⁴³

To summarize thus far, ex post finality rules, especially receiver finality, promise greater internalization of costs than do other rules. But in order to be effective, they must be credible. And there are strong reasons to believe the risk allocations in such rules might not be enforced in an actual settlement failure. How, then, could policymakers design a credible finality rule?

A credible finality rule requires some sort of precommitment on the part of authorities not to intervene to prevent a settlement failure. Otherwise, it seems likely that expectation of a bailout would influence banks' decisions. While authorities could issue verbal assurances that no bailout

⁴³There is an analogous problem with insurance against earthquakes: "...insurance is seen to some extent as a substitute for making...changes that would reduce risks." U.S. Senate (1987), p. 35.

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would be forthcoming in a settlement failure, such policies might not be believed. It is more likely that an automatic procedure that removes discretion from regulators would be credible as a risk allocation policy.

For example, suppose network participants were required to post collateral that would be used to cover receiving banks' losses in a settlement failure. For receiver finality or settlement finality based on exposure, collateral could be equal to a bank's highest net credit limit.⁴⁴ For settlement finality that distributes losses among all members, collateral could be based on the loss allocation scheme. In either case, a mechanism could be established for automatically applying losses from a settlement failure to the receiving banks' posted collateral. This could take the form of an automatic discount window loan to the exposed receiving banks. Whatever the mechanism, however, the main point is to provide increase certainty of risk allocation by reducing the amount of discretion available to regulators in handling an actual settlement failure.

In choosing a finality rule, then, it is important to ask if the risk allocation in each rule is enforceable. If, for example, a credible means of distributing losses over receiving banks can be found, then receiver finality or an ex post settlement finality rule might be feasible. This would allow an essentially market-based means of reducing risk. If loss allocations are not credible, however, then there may be little point to such rules except that they discourage unwinds of settlement. But this same objective could be accomplished by an ex ante settlement finality rule, that is, sending bank collateralization. While this would do little to reduce credit risk, it would

⁴⁴This would also help prevent banks from walking away from their obligations and thereby necessitating a settlement unwind.

at least guarantee systemic stability and provide certainty to participants. The job of reducing risk would for better or worse be left to regulation by such means as net debit caps and more intense supervision.

VI. Legal or Regulatory Reform?

Given the above considerations regarding finality rules, the question remains of whether finality rules should appropriately be codified in the law or left to agreements and regulation. There are at least two reasons for writing a finality rule into the law. First, it would provide a "model" rule on which private agreements could be based. In other words, if the UCC's draftsmen could agree on what constitutes an ideal rule, it would set the bounds within which variations from the law would take place. Second, having the rule in the law would inject a higher element of certainty into commercial and financial relationships than would result from relying on either administrative regulation or the development of case law.

Unfortunately, as outlined above there are factors that may make even the most stringent finality rule ineffective. First, misperception of risks in the payment system may dull the effectiveness of receiver or ex post settlement finality rules as means of bringing about the internalization of risks. Second and more serious, expectation of a bailout of the settlement failure may make the risk allocation in a finality rule irrelevant since participants do not expect it to be enforced. Thus, whatever a finality rule promises, it could be undermined by either informational or policy factors. But if this is true, such a rule should not be enshrined in the law.

It is also possible that, despite the desideratum that provisions of the UCC be uniform across states, there could be differences in the provisions actually enacted. The result could be different finality rules for different

states, and this would seriously detract from the certainty and coherence that one would hope to find in the legal environment.

Further, whatever rule is adopted, it could actually apply to few transactions. The UCC would not apply directly to Fedwire since Regulation J effectively provides both guarantee of settlement and receiver finality. With regard to private networks, however, the result would depend on whether network participants could vary the finality rule by agreement. If on the one hand CHIPS participants were allowed to contract their way out of a finality rule by network agreement, then whatever rule is in the law could be left applying to a narrow class of transactions. If, on the other hand, the law does not allow participants to contract out of the rule, then it raises a new question: Should the right to vary the finality rule by agreement be restricted? Unless one were totally convinced of the absolute superiority of the rule in the law, the desirability of restricting the right to contract is questionable.

A final problem with writing a finality rule into the law is complexity. The two polar cases of rules, check finality and receiver finality, would be fairly simple to codify. Check finality would make payment final when the receiving bank has final settlement, although the resulting risk allocation would be anything but simple. Receiver finality would make payment final and discharge the sender's obligation when the receiving bank accepts the payment message. The three settlement finality alternatives, however, would be far more complex, and might be better left to administrative regulation or system rules. But this would leave open the question of when the sender's obligation is discharged. The objective then becomes to determine an appropriate balance between law and regulation.

An instructive example of the problems involved in putting a finality rule into the law may be found in the current incarnation of UCC Draft Article 4A.⁴⁵ The draft provides for receiver finality provided no settlement failure occurs, but provides for a bypass of the failed bank in certain circumstances in order to assure completion of settlement if failure occurs. That is, failure of a bank in a payment chain consisting of more than two banks triggers provisions (the "skip rule") that excuse the obligation to pay the failed bank and for the failed bank to pay the next bank in the chain. The provisions substitute for this obligation a new obligation between the party formerly paying the failed bank and the bank that would have received payment from the failed bank. Settlement of the new obligations can take place and no one need bear losses. Some exceptions exist, however. For example, if the failed bank is a foreign bank, the receiving bank could revoke funds previously released to the receiver (under an agreement of provisionality) and thereby reinstate the underlying obligation between the sender and receiver. More important, the skip rule does not apply to transactions involving only two banks as in Figure 1. In two-bank transfers in which the sending bank fails, payments to receivers could be revoked.

The draft does have the virtue of specifying when the underlying obligations is discharged. Still, what is the point of receiver finality if it does not apply in the event of settlement failure? After all, receiver finality is meant to influence behavior and encourage risk control in order to avoid the losses allocated by the rule in the event of settlement failure. To

⁴⁵Jordan and Warren (1987).

have receiver finality only if no bank fails is akin to leaving streetlights on during the day but turning them off at night to conserve energy.

But even turning aside this basic objection, there remains the problem of implementing the skip rule as spelled out in the draft Code. While the draft specifies in detail the new obligations created by a network bank's failure, it does not outline a mechanism for settling the new obligations. The complexity of such a mechanism should not be underestimated, since many network participants will have no idea which banks are on the other side of a transaction involving a failed bank. And as the draftsmen acknowledge, it is essential that settlement take place promptly.⁴⁶

While the draft Code provisions do not specify a settlement mechanism, the authors suggest in their Comment that the insolvency receiver (most likely one of the deposit insurance funds) would have the necessary data to set up a settlement account that would implement the skip rule.⁴⁷ Alternatively, the Federal Reserve or state regulatory agency could handle the chore using data furnished by the receiver. The problem is, the draft provisions would create a substantial addition to the burden faced by regulators in dealing with a failed bank while attempting to entirely relieve other banks of any losses. The solution seems particularly ironic since it would relieve banks of losses in the one event in which receiver finality is designed to impose losses on them while retaining receiver finality for situations in which it has no behavioral effects. So while the draft would lift the burden of settlement losses from banks and thereby obviate the necessity to monitor sending banks,

⁴⁶Ibid, p. 82.

⁴⁷Ibid, p. 83.

implementing the skip rule would entail substantial administrative costs that must eventually be passed on to the public.

Given the difficulties in writing a finality rule into the law, what should be the respective contributions of legal reform and regulatory reform? The comparative advantage of legal reform should be in areas of general principle that do not require detailed specification of actions to be taken in specific situations. For example, the law seems the appropriate place for clarifying the relationship between the sender and receiver whose transaction is the underlying reason for a wire transfer. Because the sender and receiver will not always have continuing relationships, they are unlikely to have incentives to contractually specify their rights and obligations. If the law does nothing more than make clear when the sender's obligation to the receiver is discharged, then it will remove much potential for uncertainty and litigation while saving the parties the cost of drawing up a detailed contract. And despite its disadvantages, a check finality rule would serve this purpose.

In contrast, regulatory action seems best suited for those risk reduction tasks that require both detailed specification and flexibility. For example, any rule requiring collateralization for its effective implementation will probably have to be spelled out in fairly minute detail. But such detail means more occasion for changes, and this is more difficult and slow for the law than for administrative regulation. Which brings up flexibility. By its nature, the law is more difficult to change, especially if it requires the approval of each state legislature and that only after a lengthy process of drafting. While regulatory bodies might not be known for willingness to adjust to changes, at least they are capable of instituting, modifying, and revoking rules when the need arises.

But the question remains of whether the law is the appropriate place to specify a finality rule. Given the problems described above regarding risk misperception and the likelihood that finality rules will actually be enforced in the event of a settlement failure, it seems futile to put receiver finality into the law. The same problem exists for ex post settlement finality rules, but there is the additional problem that such rules would require rather complex specification better left to administrative regulation. Ex ante sender collateralization would get around the informational and bailout problems, but would again be somewhat complex to write into the law. Lastly, check finality would simply require the law to discharge the obligation when settlement occurs. As pointed out above, however, the ambiguous risk allocation is not particularly effective either for risk reduction or risk spreading. But at least the uncertainty regarding discharge is reduced, and administrative regulation or network rules could then take care of the more detailed risk reduction tasks.

One possibility for a "backstop" settlement finality rule would be to include in the new Code provisions forbidding settlement entries from being unwound. In other words, senders or sending banks could not revoke transfers,⁴⁸ nor could settlement entries between banks be reversed. The law would not have to go into further detail, but would leave wire transfer networks or their regulators with a choice. They could require sending bank collateralization under an ex ante rule. Or they could develop a loss allocation scheme (probably with receiving bank collateralization) under an ex

⁴⁸This is now part of the case law of electronic funds transfer. *Delbrueck & Co. vs. Manufacturers Hanover Trust Co.* 609 F.2d 1047 (2d Cir. 1979).

post settlement finality rule. They could even go all the way and institute receiver finality. The choice would hinge on whether a rule could be developed with teeth so banks know they will bear the risks as specified. Unlike Jordan and Warren's skip rule, the law would avoid specifying detailed requirements but omit the matter of implementation. Rather, the law would specify a result, namely, no unwinds, and leave the rest of the matter to networks and public officials. Equally important, the law would not embody a rule that would be automatically abandoned in precisely the situation for which it was designed.

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APPENDIX: WHOLESALE WIRE TRANSFER NETWORKS¹

Wholesale wire transfer, also called large-dollar wire transfer, refers to payment networks that electronically transfer payments between depository institutions. The payments may be for the depository institutions' own benefit or for the benefit of their corporate or government customers. Retail customers of depository institutions seldom have occasion to use wholesale wire transfer. In contrast, retail wire transfer includes automated teller machine networks, point of sale systems, bank credit card networks, and other consumer-oriented forms of funds transfer.

Fedwire is the wire transfer network operated by the Federal Reserve Banks. Currently, more than 220,000 Fedwire funds transfer transactions totaling over \$638 billion occur on an average day. Mean transfer size is about \$2.9 million. Transfers involving book-entry U.S. government securities number approximately 40,000 per day for a total daily value of over \$350 billion. Average securities transfer size is \$8.7 million. Both funds and securities transfers have grown dramatically over the past decade. An important distinction between Fedwire and other networks is that settlement of transactions made over Fedwire is immediate, inasmuch as it occurs by means of credits and debits to depository institution reserve accounts on the books of the Federal Reserve Banks. Because the immediate settlement feature means that Fedwire transactions constitute "good" or final funds as soon as notification of payment is made, banks participating in Fedwire as receivers of payments are relieved of risk. The risk that the sending bank may not be

¹The Appendix is adopted from Mingle et al. (1987).

able to fund its position is borne by the Federal Reserve when it accepts and settles a Fedwire transfer.

CHIPS The Clearing House Interbank Payments System (CHIPS) is a privately operated funds transfer wire network associated with the New York Clearing House. About one-half of its transfers concern international dollar transactions involving U.S. depository institutions. As of March 1988, approximately 134,000 funds transfers amounting to almost \$622 billion were transacted on CHIPS daily. The average transaction was approximately \$4.6 million. CHIPS was started in 1970 to efficiently transfer interbank balances involving international transfer of dollars on the books of the New York Clearing House Association banks. This essentially eliminated the use of the paper draft to effect the transfers. While payment messages are sent over CHIPS throughout the business day, actual settlement of net debit and credit positions takes place at the end of the day through a special account at the Federal Reserve Bank of New York. CHIPS currently has 137 participating institutions, of which twenty-one settle directly with the network. Nonsettling participants must settle their CHIPS transfers on the books of one of the eleven New York Clearing House banks.

Policies to Control Risks In recognition of concerns about intraday credit risks, the Board of Governors of the Federal Reserve System in 1986 implemented a voluntary program to limit intraday credit and improve control over risk by users of all large dollar wire transfer networks. The current program is voluntary and consists of three main elements.

- (1) Banks using any large-dollar wire transfer system are requested to perform a self-evaluation based on their operational and credit controls, policies, and procedures, as well as their creditworthiness or ability to fund themselves to cover unexpectedly large funds outflows or reduced inflows.

- (2) Based on the results of the self-evaluation, each participant adopts a total ratio of Fedwire daylight overdrafts plus CHIPS net debits to capital as its limit on how much a participant may send out in excess of what it receives across all networks. The ratio is called a cross-system net debit cap multiple.
- (3) Participants also establish network-specific sender net debit caps as well as bilateral net credit limits (limits on how much a receiving bank may be a creditor to a particular sending bank) on CHIPS to obtain net settlement services from the Federal Reserve.

Under the policy, CHIPS participants are required to compute two net debit caps. First, cross-system caps covering Fedwire and CHIPS together are calculated as a multiple of capital. Second, a network-specific cap for CHIPS is based on a formula that attempts to capture the market's assessment of other CHIPS participants' soundness. If a bank only uses Fedwire, then its cross-system cap and its network-specific cap are one and the same.