Monetary Issues and Payment System Design

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An important banking issue for many developing countries is whether to install an electronic interbank funds transfer system. A further issue concerns the type of system that offers the best design from the standpoint of users of the system as well as the public at large. Indeed, these issues are relevant in a number of developed countries. The central banks of the European Union, for example, recently published a report on the minimum common features that are desirable for domestic payment systems, with an important emphasis on the features of large-value interbank systems.¹

This chapter focuses on the interrelationship of monetary issues and the design of large-value payment systems. It discusses the monetary rationale for installing an electronic interbank funds transfer system and deals with the influence of central bank monetary regulations and procedures on the incentives to support the installation and use of real-time gross settlement and multilateral net settlement systems.

Modern designs for such automated systems involve the electronic sending and receiving of payment messages between banks. These payment messages can be either for the benefit of the banks themselves or for the benefit of bank customers. Both types of designs also typically require settlement of the payment messages on the same day that payment messages are sent and received (same-day settlement) in central bank balances—central bank money—held in sight accounts at a central bank.²

The design of the real-time gross settlement system embodies the principle that payments are settled one at a time by debiting and crediting the sending and receiving banks' money balances, respectively, in accounts at

¹See Working Group on EC Payment Systems, Report to the Committee of Governors of the Central Banks of the Member Countries of the European Economic Community on Minimum Common Features for Domestic Payment Systems (November 1993).

²Some large-value transfer systems provide for settlement in commercial bank balances. Such arrangements for large-scale interbank funds transfer systems raise important issues of systemic risk, which are discussed in other chapters in this book. There are also examples of electronic interbank funds transfer systems that settle the day after payment messages are sent and received.
a central bank. The concept behind this procedure is that a transfer of central bank money representing the settlement of each payment is unconditional and irrevocable when it is made, thus satisfying the obligation of the sending bank to make the payment. As discussed in Chapter 6, Fedwire, the Swiss Interbank Clearing System, and The Bank of Japan's real-time gross settlement service provided through BOJ-NET are examples of such systems. In practice, technical issues or cost considerations may limit the ability of a central bank to perform the real-time accounting necessary to permit real-time transfers of central bank money, which leads to minor technical variations on the real-time gross settlement principle.3

Multilateral netting systems embody a fundamentally different principle than gross settlement in real time. Electronic messages are exchanged between participants in these systems, possibly in real time. These messages reflect obligations to pay central bank money at a periodic settlement time, such as the end of a banking day, subject to mutual offset among members of the netting arrangement. Under clearinghouse rules and procedures, settlement obligations are calculated from the multilateral net value of payment messages sent to and received from participants in the system. Participants that are in a multilateral net debit position at settlement time, generally at the end of the banking day, settle their obligation by paying central bank money, in some cases using a real-time gross settlement system. The Clearing House Interbank Payments System (CHIPS) in the United States and the Clearing House Automated Payment System (CHAPS) in the United Kingdom are examples of multilateral netting systems. In some countries, such as Japan and the United States, both real-time gross settlement and multilateral net settlement systems are in operation.

**Monetary Rationale for Large-Value Transfer Systems**

Automated large-value interbank funds transfer systems are generally regarded as a key component of the infrastructure in modern financial markets. A major function of these systems is to speed up dramatically the communication, processing, and settlement of large-value payments. This infrastructure, in turn, has the potential to produce a number of long-term benefits for monetary arrangements in most countries.

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4For example, the complete set of accounts held at the central bank might be updated once a day, but with real-time logging and control of real-time gross settlement funds transfers. Special central bank subaccounts might also be established for such a real-time gross settlement system, with real-time accounting performed for the subaccounts, but not for the entire set of accounts held at the central bank. The important feature of a real-time gross settlement system from a financial perspective is that irrevocable, unconditional funds are given to the bank receiving a payment message.
One simple but important benefit is the linking together of regional centers of commerce and finance. Automated large-value systems with same-day settlement permit the transfer of funds between regions on a same-day basis, reducing or eliminating the need for interregional transfers of large-value paper payment instruments, which may entail long delays in clearing with attendant risks and financial float (see Chapter 10). A reduction in clearing delays, as well as a reduction in the uncertainty about settlement times, will tend to strengthen financial linkages among regions in a country and to equalize short-term money market rates across regions.

From a macroeconomic perspective, an automated large-value interbank payment system may greatly facilitate the establishment of short-term money markets that reflect nationwide monetary conditions at a particular time. Such markets, in turn, provide more accurate information about the current state of nationwide monetary conditions. In addition, monetary policy changes implemented in one city or region will tend to spread rapidly and influence nationwide monetary conditions.

At the microeconomic level, the installation of automated large-value transfer systems can enhance the liquidity both of interbank money markets and of individual banking organizations. Rapid and low-cost payment systems, particularly those with same-day settlement, allow the timely and low-cost settlement of trading in interbank loans, deposits, or other contracts for money.\(^4\) By lowering the direct and indirect costs of settlement, such systems can be expected to increase the incentives for market development. Liquid markets, in turn, tend to reduce the reliance of the banking sector on the central bank for liquidity and to promote market-oriented reserve management practices by banks. The result is likely to increase the liquidity adjustment capabilities, and thus the liquidity, of individual banking organizations.

In addition, a more liquid interbank money market may provide added flexibility for the conduct of central bank monetary operations. For a variety of reasons, a central bank may wish to adopt market-oriented procedures for increasing or decreasing the aggregate supply of central bank money to an economy. A liquid interbank money market may provide either a readily available market in which central bank operations can be conducted directly and with precision, or a market in which the banking system can adjust reserve positions rapidly in response to such operations conducted in other financial markets.

The introduction of automated payment systems may lead to and be accompanied by changes in the demand for central bank balances. Such systems, combined with significant automation capabilities at commercial

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\(^4\) Improvements in interbank funds transfer systems may also help stimulate the development of improved methods for clearing and settling various types of securities.
banks using the system, may permit a given daily value of payments to be cleared and settled with a much smaller stock of central bank money than was needed previously. Depending on a number of factors, the demand for central bank money to be held overnight by the banking system may decline from levels that prevailed before the automated system was introduced. Thus, some short-term adjustments in monetary forecasting and central bank procedures may be needed as major improvements in interbank funds transfer systems are introduced.

Monetary Incentives for Choosing Among Large-Value Transfer Systems

The remainder of this chapter discusses the monetary incentives for the private banking sector to prefer either real-time gross settlement or multilateral net settlement systems, assuming the choice has been made to install at least one interbank funds transfer system in an economy. It does not address the issue of who makes the decision to install such a system.

If it is assumed that both a real-time gross settlement and a multilateral net settlement system would be constructed to use central bank money for settling payments, the monetary incentives to use one system or another depend largely on the cost of obtaining the relevant type of central bank money for settlements. Further, since multilateral net settlement systems settle payments on a multilateral net basis at the end of a banking day instead of sequentially in real time, these systems can generally be expected to require less central bank money to settle a given value of payments than a real-time gross settlement system. Thus, the higher the relevant measure of the cost of using central bank money to settle payments, the greater the monetary incentive for commercial bank holders of central bank money to install and use multilateral net settlement systems rather than real-time gross settlement systems.

The incremental or marginal cost of central bank money is the most relevant factor for choosing between interbank funds transfer systems, because the added expense of participating in a system that utilizes incrementally larger amounts of central bank money for a given group of payments will depend on the (estimated) incremental amount of central bank money to be used, multiplied by the (estimated) incremental cost of obtaining that money.

The standard concept for measuring the incremental or marginal cost of central bank money, which is adopted here, is the concept of "opportunity cost." This concept recognizes that central banks typically do not pay interest on money balances held with them. Further, if interest was paid, the rate would probably be below market rates. Thus, the opportunity cost of holding central bank money is the (risk-adjusted) rate of
interest forgone by holding non-interest-bearing balances at a central bank. In other words, the opportunity cost is the market rate of interest that could be earned on these funds if they were invested in financial assets of approximately equal liquidity and risk. Although it may be difficult to calculate this opportunity cost precisely, the concept is straightforward. The opportunity cost is usually approximated in economies with liquid interbank markets by the rate of interest paid on investments in overnight interbank deposits or related instruments.

For payment systems that feature same-day settlement, the relevant opportunity cost is the cost of the central bank money used by these payment systems for settlement. Further, the relevant opportunity cost for settling payments using a real-time gross settlement system that operates during the banking day is the opportunity cost of obtaining central bank money during the day to settle payments. This intraday opportunity cost may differ substantially from the opportunity cost of central bank balances on an overnight basis.

In a market-oriented analysis, opportunity cost will be determined by the demand for central bank money in relation to supply. This demand must be analyzed separately for both settlement systems. For a multilateral net settlement system, the sum of all multilateral net settlement positions (positive and negative) is equal to zero, since the total amount of money to be paid by participants equals the total amount to be received.\(^5\) Thus, the net aggregate demand for central bank money to be used at settlement is zero, except where settlement debits and credits are not posted simultaneously to central bank accounts. In this case, debtors typically pay central bank money, for example, into a settlement account maintained at the central bank, before creditors receive funds. This procedure generates a temporary additional net demand for balances.\(^6\) To compare the incremental monetary costs of both systems, the issue of the relative demand for money that arises in each type of system can be addressed in terms of the extent to which a real-time gross settlement system increases the demand for central bank money in comparison with the relatively low demand associated with multilateral net settlement systems.

The actual demand for central bank money generated by the installation of a real-time gross settlement system will depend on factors such as the value and timing of the flow of large-value interbank payments. The potential size and timing of these flows is essentially an empirical issue.

\(^5\)However, there are still flows of central bank money from participants in a net debtor position at settlement to those in a net creditor position.

\(^6\)In CHIPS, at settlement net debtors must pay central bank money representing their settlement obligations into a settlement account at the Federal Reserve before net creditors are paid from the account via Fedwire funds transfers.
that must be addressed for specific economies and proposed payment systems.

The supply of central bank money, however, particularly during the banking day, is under the control of the central bank. Central bank monetary regulations and credit policies will have significant effects on supply, and hence on the opportunity cost of central bank money during the day. Supply policies may even be designed to produce particular levels of, or to place bounds on, the intraday opportunity cost of balances that are independent of the level of demand. Indeed, a supply policy of reducing the intraday opportunity cost of central bank money to approximately zero by accommodating all demand (without charge) would presumably eliminate this cost as an influence on the choice between real-time gross settlement and multilateral net settlement systems.

**Monetary Regulations**

At least three central bank monetary regulations will influence the level of balances of central bank money held overnight by commercial banks. These regulations include (1) the level of reserve requirements, if any, applied to commercial bank liabilities; (2) the instruments in which such required reserves may be held; and (3) the rate of interest, if any, paid on balances of central bank money. If any monetary regulations increase overnight sight balances held at a central bank, these balances are a potential source of supply of central bank money for use in settling payments during the day. Whether a central bank permits these balances to be used in this manner can be viewed as part of the central bank’s supply policy.

First, reserve requirements may generate substantial levels of holdings of central bank money on an overnight basis. If a central bank permits these required balances to be used to settle payments, and the balances are large in relation to the value of payments to be settled, the opportunity cost to the banking sector of using central bank money to settle payments may be quite low, even zero. On the other hand, if reserve requirements are low, the opportunity cost of holding additional amounts of central bank money solely to settle payments during the day may approach, or equal, the level of interest rates in an overnight interbank market for central bank money.

The level of overnight balances can be viewed as the outcome of both a regulatory demand for overnight balances by commercial banks and the supply of balances by the central bank that is a function of the implementation of monetary policy.

If an intraday interbank funds market, or intraday central bank credit, are sources of supply of money for settling payments, the rates, terms, and conditions for use of funds from these sources will have an important effect on, and may well significantly lower, the opportunity cost of obtaining incremental balances of central bank money for settling payments. This issue is discussed below.
Reserve requirements may change over time with possible effects on payment systems. For example, the lowering of reserve requirements may increase the opportunity cost of holding central bank money to settle payments. Lower reserve requirements in turn may increase incentives to install and/or use multilateral net settlement systems to economize on such central bank money.

Second, the instruments in which required reserves may be held will influence the monetary balances available for settling payments. In some countries, commercial banks are permitted to count the currency they hold toward their required reserves. For a number of reasons, however, currency is not a useful asset for settling payments processed by automated systems. Deposit money in the form of electronic records is much more practical for these purposes. Thus, reserve requirement regimes that favor large holdings of currency will not reduce the opportunity cost of central bank money used for settling payments as much as regimes that favor large holdings of (sight) deposit money at the central bank.

Banks can be required to hold reserves in segregated accounts that cannot be used for payment. Such arrangements may be imposed as prudential measures to ensure that funds will be available in all circumstances to meet customer withdrawals. More typically, such arrangements are designed indirectly to tax banking organizations and finance government debt, in which central banks invest the segregated funds. Lacking the transferability needed to serve as a monetary asset for interbank settlement, such reserves are virtually useless for payment purposes on a day-to-day basis. Thus, frozen reserves do not reduce the opportunity cost of central bank money for settling payments and can be viewed as increasing that opportunity cost relative to a regime in which these reserves can be used for settlement.

Third, the rate of interest paid on central bank money will have important effects on the opportunity cost of these balances. For example, if interest is paid on reserves held overnight, the (overnight) demand for this money would be expected to be higher than if no interest were paid. Larger holdings of central bank money overnight would increase the stock of balances that could be used for settling payments, assuming a central bank makes these funds available to banks during the day. A larger supply of balances, other things equal, implies a lower opportunity cost of using central bank money for settlement.

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9 In theory, government tax and financing objectives can be met by requiring balances to be held overnight in segregated accounts, while allowing these funds to be used for making payments during the business day.

10 Interest-bearing central bank securities or term deposits may be examples of instruments that central banks would not consider to be available for settling payments. These instruments are sometimes issued for monetary policy or exchange management purposes.
Typically, however, no interest is paid on central bank money. Accordingly, balances held overnight at the central bank will be an unattractive investment relative to short-term investments that pay a return. In general, the lower the interest rate paid on central bank money relative to rates paid on alternative bank investments, particularly highly liquid investments, the higher the opportunity cost of holding central bank money. Further, the higher the inflation rate in a country, the greater will be the opportunity cost, since market interest rates on alternative investments would likely include an inflation premium that a central bank would be unlikely to pay. If a central bank does not pay interest, the entire inflation premium contained in market rates would be part of the opportunity cost of holding central bank balances.

Other central bank procedures may also affect the opportunity cost of using central bank money for settlements. This section has described the key role played by policies and procedures that govern whether overnight balances are available for settling payments during the day. A further issue is whether central bank accounts and procedures are structured in a way that enables banks to consolidate and use their holdings of central bank money during the day to settle payments. If banks hold multiple accounts with a central bank and cannot readily consolidate funds, the opportunity cost of using central bank money for settlement may be higher than it would be otherwise.

Central Bank Credit Facilities

Central bank credit facilities may be significant sources of supply of central bank money and have important effects on opportunity costs. These credit facilities can be categorized for payment system analysis as overnight and longer-term facilities, or as intraday facilities. Some intraday facilities are explicitly overdraft facilities, whereas others are implicit arrangements that are a by-product of traditional end-of-day central bank accounting procedures.

Explicit overnight and longer-term credit facilities are designed to provide central bank money to the borrowing institution on an interday basis. These arrangements affect the opportunity cost of using central bank money for settling payments in at least three ways. First, there is normally an explicit interest charge for credit. This charge may be set at a premium over interbank market rates or at a discount, depending on central bank procedures. Second, the terms for providing credit are important. Borrowing from the central bank within certain limits may be considered a right or a privilege and may be subject to varying degrees of administrative encouragement or discouragement by the central bank. Explicit administrative rationing, including the setting of quotas, is employed by some central
banks. Collateral is also typically required. These nonprice aspects of credit essentially raise or lower the combined explicit and implicit charge for obtaining central bank money.

In the case of collateral, interest earned on the collateral may be passed on to the bank that owns the securities or other assets posted as collateral. Any assumed increase in the cost of obtaining central bank money owing to the need to post collateral for a loan results from the possibility that pledging the collateral for a loan entails some economic cost to the pledging bank. Whether such costs exist will depend on the specific type of collateral and the circumstances involved.

Third, the timing of borrowing and repayment of central bank credit can affect the use of credit facilities for settling payments. In some countries, potential account overdrafts at a central bank resulting from real-time gross settlement or other payment system activity may be covered automatically by extensions of central bank credit, if sufficient collateral is posted and credit lines are available. Lombard facilities have operated historically in this manner. In theory, payment-related credit can be extended throughout the day, with final end-of-day positions reflecting the actual overnight loan to be "booked" by the central bank. If the (overnight) central bank interest rate is applied only to net end-of-day credit, substantial amounts of intraday balances may be obtained at a very low, or zero, interest rate.

To use a specific example, the Federal Reserve’s discount window clearly distinguishes between intraday and overnight lending. Discount window loans are normally made at the end of the business day for a 24-hour period, in part, to avoid confusion between intraday and overnight lending that might result from the type of end-of-day overdraft banking described above. Further, in an environment where intraday credit and money balances may have value, and intraday interest rates may exist, the central bank rate for a 24-hour loan provides a clear yardstick against which to evaluate combinations of overnight and intraday interest rates.

Another timing dimension of central bank credit facilities is the minimum time for which a loan may be obtained. For example, if loans must be taken out for periods longer than one day, borrowing to finance adverse payment flows on one day that are reversed on the next will have to be invested for the remainder of the term of the borrowing from the central bank or remain idle. In such a case, restrictions placed on central bank borrowing may add to the opportunity cost of obtaining central bank money to settle payments.

Central bank intraday credit facilities should also be thought of as having traditional dimensions such as rates, duration, and other terms. To date, only the Federal Reserve has adopted a program to charge for intraday central bank credit, which began in April 1994. Other central banks either do not provide explicit intraday credit, provide it but do not charge,
or provide it implicitly through the operation of their accounting or payment systems.

If quantitative limits, or other conditions, are placed on the use of intraday credit, including collateralization requirements, the implicit cost of the credit will tend to rise. Similarly, the greater the flexibility to borrow and repay during the day, the lower the implicit cost of daylight credit and the associated opportunity cost of the central bank money created by central bank lending.

As discussed in Chapter 10, float can also be a major source of increases or decreases in central bank credit. Central bank money can be provided to or withdrawn from the financial system when float is generated by the operation of central bank payment mechanisms, either on an intraday or interday basis with attendant consequences for the opportunity cost of using central bank money to settle payments. Central bank float may be priced and may be subject to nonprice terms, with attendant implications for the opportunity cost of central bank money.

Policy Influences on Payment System Choice and Use

Table 1 sets out the impact of the factors discussed in the last two sections on the opportunity cost of central bank money and on the private sector's incentives to install and use real-time gross settlement or multilateral net settlement systems. A plus sign indicates an increase in the opportunity cost of central bank money used to settle payments and an increase in the incentive for banks to prefer the indicated payment system. A minus sign indicates a decrease in the opportunity cost of central bank money and a decrease in the incentive to prefer the indicated system. As discussed in previous sections, since real-time gross settlement systems tend to use central bank money more intensively than do netting systems, a higher opportunity cost of money for settling payments (+) will be associated with a reduced incentive (-) to prefer real-time gross settlement systems and an increased incentive (+) to prefer multilateral net settlement systems, and vice versa.

As shown in Table 1, the major monetary and credit regulations and policies affecting the choice of payment systems are (1) reserve requirements; (2) the mix of instruments provided for holding reserves; (3) the payment of interest on central bank balances; and (4) the granting of intraday central bank credit with no or limited interest charged. Collateral requirements are also included in the table for reference.

Overall, if required reserves are sufficiently large and can be used to settle payments, they will lower the opportunity cost of using central bank money for settlement, increase the incentive to install and use a real-time
Table 1. Impact of Regulatory and Credit Policies on the Opportunity Cost of Central Bank Money and Choices Between Payment Systems

<table>
<thead>
<tr>
<th>Regulatory Policy</th>
<th>Impact on Opportunity Cost</th>
<th>Real-time gross</th>
<th>Multilateral netting</th>
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<td>Reserve requirements</td>
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<tr>
<td>Instruments for holding reserves</td>
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<tr>
<td>Currency</td>
<td>+</td>
<td>-</td>
<td>+</td>
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<tr>
<td>Interest-bearing securities</td>
<td>+</td>
<td>-</td>
<td>+</td>
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<tr>
<td>Blocked accounts</td>
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<td>-</td>
<td>+</td>
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<td>Interest paid on central bank money</td>
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<tr>
<td>Intraday central bank credit facilities</td>
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<tr>
<td>(no or limited interest)</td>
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<td>+</td>
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<tr>
<td>Collateral requirements for central bank credit</td>
<td>0/+</td>
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1Plus sign indicates an increase in the opportunity cost or increase in incentive; a minus sign indicates a decrease in the opportunity cost or decrease in incentive; and zero indicates no impact on opportunity cost or change in incentive.

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Conclusions

There are monetary advantages to a country's banking and financial systems from having a large-value interbank funds transfer system. Differing monetary incentives may affect choices between real-time gross settlement and multilateral net settlement systems. Multilateral net settlement systems tend to economize on the use of central bank money relative to real-time gross settlement systems, essentially by substituting explicit or implicit interbank intraday credit, extended through netting, for central bank money. Further, an economy's monetary regulations and procedures can raise or lower the opportunity cost of holding and using central bank money to settle payments through effects on the supply of such balances relative to demand. The incentives represented by this opportunity cost can lead the private banking sector to prefer the establishment of multilateral net settlement systems, which economize on central bank money, compared with real-time gross settlement systems.

The monetary incentives experienced by the commercial banking sector, however, may not, and perhaps should not, be the decisive factor in the final decision on installation and use of interbank funds transfer systems. The commercial banking sector, the central bank, and other authorities must also consider issues relating to the stability of the payment system, particularly during times of financial stress. Other issues involving payment system risk, technology, and access to the payment system will also need to be addressed. Nonetheless, money and credit issues have an important influence on the incentive for choosing one type of system over another, and often influence the discussion and analysis of the merits of different types of large-value payment systems.