Banking and the Payment System

Hans J. Blommestein and Bruce J. Summers

A modern market economy depends on an effective and efficient payment system. Indeed, the efficiency of transactions in a market economy is to a large extent determined by the efficiency of the payment system. Key elements of the payment system are provided through services supplied by banks and through the infrastructure of the banking system—the central bank plus commercial banks. Accordingly, to understand how a modern payment system functions, it is necessary to understand the role played by banks as providers of payment services and the role of the banking system as a whole.

This chapter describes the structure and organization of the banking system in terms of its relationship to the payment system in a market economy. It describes the role of banks as providers of payment services and analyzes the interbank account relationships that permit a complex payment system to operate efficiently. It describes the role of the central bank in interbank settlement, discusses the interplay between the payment system and the money market, and presents a conceptual model of the payment and settlement system.

Bank Payment Services

A modern market economy is often described as having a two-tier banking structure. Under a two-tier banking structure, commercial banks provide services to the nonbank public, including nonbank financial firms, as well as to other commercial banks. The central bank, in turn, provides services to commercial banks and issues bank notes and coins (currency). The core services that banks provide are deposits (bank liabilities) and loans (bank assets). Of course, in accepting deposits, banks must maintain accounts for their customers.

1The authors appreciate comments on an earlier draft of this chapter by R. Alton Gilbert and Anatoli Kuprianov, of the Federal Reserve Banks of St. Louis and Richmond, respectively.
Directly related to the deposit, loan, and associated account services that banks provide to their customers are payment services. Bank payment services must be competitive vis-à-vis currency supplied by the central bank, which means that bank customers must find advantages to using bank deposit money rather than currency for at least some of their transactions. To be competitive vis-à-vis currency for purposes of payment, bank deposit money must meet two conditions. First, banks must provide transfer facilities for moving deposit money from account to account that are attractive to their customers. Attributes of an attractive funds transfer service include reliability, speed, low cost, and the provision of good records of transactions. Second, banks must provide conversion facilities that readily allow their customers to make and receive payments using bank deposit money in a variety of forms that are readily convertible with each other and with currency.

In fact, noncash payments account for the largest share of the total value of payments in a modern economy. In the United States, for example, noncash payments are estimated to account for nearly 100 percent of the value of all transactions. The public’s demand for noncash payment services is satisfied in a competitive setting by the commercial banking system, which offers a wide variety of payment instruments to the public. Every economic actor depends on the payment system both to originate and to receive payments. Banks therefore strive to meet the needs of their customers both as originators and as receivers of payments. Not all customers are alike, and consequently banks must develop specialized business and marketing strategies for payment services, deciding whether they will compete in a limited segment of the market for payment services or attempt to offer a wide array of services. The most basic distinction between market segments in payments, as well as other banking services, is wholesale versus retail. The payment needs of the wholesale and retail markets, and the services devised by banks to meet those needs, are treated in Chapters 6 and 8, respectively.

Above all, a user of payment services expects to have convertibility among the different types of payment instruments that circulate among banks. An account holder who is the payee in a transaction will want to be able to receive payments into his bank account regardless of the choice of instrument made by the originator of the payment. For example, a payee may at any time receive payment in the form of a paper draft or an electronic giro, and may be asked to participate in an automatic debit program—all or any of which he will want to do to facilitate speedy and reliable payment. Consequently, a minimum condition for a bank to participate as a provider of payment services is that the bank must be prepared to receive virtually any type of payment instrument on behalf of its customers.

It has also become common, in both the retail and wholesale market segments, for banks to offer credit services as a direct extension of their
account and payment services. Especially for wholesale customers, and then particularly for wholesale customers that are active buyers and sellers of financial instruments, commodities, or other contracts giving rise to large payments, synchronization of inflows to and outflows from transaction accounts becomes difficult. These kinds of customers require working capital to fund their payments when expected receipts are late, and banks normally provide the type of working capital necessary to meet the needs of entities whose transactions accounts go into deficit. Within the last decade intraday credit has become a more important service that banks provide as a natural extension of the payment services they offer.

Depending on the nature of the payment business that a bank chooses to be in, its role in interbank settlement can be relatively larger or smaller. For example, as discussed in Chapter 10, a bank that is targeting primarily retail business will likely end up handling large numbers of smaller-value transactions on behalf of its retail clients. A bank competing in this market segment will probably augment the usual array of retail credit services with demand deposit account overdraft facilities to help retail clients better manage their liquidity.

A bank that is targeting primarily wholesale business will face a different type of demand for payment services. In particular, the volume, and especially the value, of transfers through the accounts that businesses hold with banks are likely to be much higher than those held for retail clients. Moreover, business customers are likely to be more demanding with respect to the bank’s performance as a provider of services. For example, as discussed in Chapter 10, businesses often require current information on their account balances to assist in their cash management. Such information may be needed early each day, and perhaps several times during the day, and, to be timely, will have to be delivered electronically. Also, overdraft services provided through these accounts will likely play an important role in meeting the working capital needs of businesses.

Financial firms that are active participants in the money and capital markets such as brokers and dealers have extremely specialized payments requirements. In particular, the business of these firms results in rapid turnover of account balances because of the very large-value transfers that they make and receive during a normal business day. Banks offering services to these types of firms are in the most specialized payments business.

**Interbank Account Relationships**

As noted above, a variety of payment instruments are available to the public for transferring deposit balances held in banks. Regardless of the particular type of instrument used, whether it is a credit or debit
instrument, and whether it is in paper or electronic form, the purpose is the same—to effect a transfer of bank balances. If a payment order involves the transfer of balances between accounts held at the same bank, the transaction is referred to as an “on us” transaction or a “book transfer.” If it involves the transfer of balances between accounts held at different banks, however, a more complex, interbank transfer comes into play.

In providing payment services, banks act as financial intermediaries. When a nonbank economic actor originates a payment to another nonbanking entity using bank deposit money, the bank of the originator of the payment and the bank of the receiver of the payment become parties to the transaction. For efficiency, originating banks may accumulate many smaller payments originated by their customers that are destined for counterparties holding accounts at another bank and send the individual payment instructions with one settlement total that satisfies the interbank claim. Alternatively, banks may participate in netting schemes by which interbank claims resulting from their own and their customer payments are offset, either bilaterally or multilaterally. With netting, the interbank settlement resulting from customer payments bears little resemblance to the size of the underlying transactions. By agreeing to handle their customers’ payment transactions, banks intermediate by assuming interbank payment and settlement obligations.

Interbank settlement obligations arising from customer payments can be settled in three basic ways. First, banks can exchange currency to discharge their interbank obligations. Although legally permissible, frequent handling of large amounts of bank notes and coins is inefficient and risky and is rarely used as a method of interbank settlement. Second, banks can settle with each other by transferring ownership of funds they hold in bilateral accounts. Third, banks can settle with each other by transferring ownership of balances in accounts they hold with a third party, either another commercial bank or the central bank. The structure of interbank account relationships that supports settlement of interbank obligations in the second and third methods is described below.

The account that one bank holds with another bank is referred to using two different names, depending on whether the reference is made from the standpoint of the bank providing the account service or the bank using the account service, although it is the same account. Say that bank X is the bank that uses the account service of another bank and owns the balances maintained in that account. Say that bank Y is the bank that provides the account service and is therefore the bank on whose books the account is maintained. For the bank using the account service (bank X), the account is known as the nostro account and bank X is the nostro bank. For the bank providing the account service (bank Y), the account is the vostro account and bank Y is the vostro bank. In some countries, vostro banks are referred to as correspondent banks and nostro banks as respondent banks.
The nostro bank owns the funds held in its nostro account and alone controls the disposition of those funds. Only the nostro bank can order funds transfers from its account. In this sense, the vostro bank is simply the administrator of payment orders made by the nostro bank.

The vostro bank, however, establishes the terms and conditions under which the nostro account can be used. For example, the vostro bank will specify the level of service it will provide, including the timeliness and accuracy with which it processes deposits to and withdrawals from the account. It will also establish a fee schedule governing the payment services it provides and may set minimum balance requirements. Finally, and most important, the vostro bank will exercise control over the amount of credit it extends to the nostro bank through the account by limiting the amount of overdrafts it will permit, either intraday or overnight.

An example of how interbank settlement takes place using the mutual accounts that commercial banks hold with one another is illustrated in Table 1. The notation used is as follows:

- \( \text{DD}_x \) = customer demand deposits held with bank X;
- \( \text{DD}_y \) = customer demand deposits held with bank Y;
- \( \text{VD}_x \) = the vostro deposit that bank Y holds for bank X;
- \( \text{VD}_y \) = the vostro deposit that bank X holds for bank Y;
- \( \text{ND}_x \) = bank Y’s nostro deposit held with bank X;
- \( \text{ND}_y \) = bank X’s nostro deposit held with bank Y;
- \( \text{OA}_y \) = other assets on bank Y’s balance sheet;
- \( \text{OA}_x \) = other assets on bank X’s balance sheet;
- \( \text{OL}_y \) = other liabilities on bank Y’s balance sheet;
- \( \text{OL}_x \) = other liabilities on bank X’s balance sheet;
- \( \text{TA}_x \) or \( \text{TA}_y \) = total assets for the respective banks; and
- \( \text{TL}_x \) or \( \text{TL}_y \) = total liabilities for the respective banks.

In this simplified example, the entire commercial banking system consists of two commercial banks, whose initial balance sheets are shown in Part I of Table 1. There is no central bank nor are there required reserves. In this system, the total deposits of the bank and nonbank public equal

\[ \text{DD}_x + \text{DD}_y + \text{VD}_y + \text{VD}_x. \]

Some simple identities hold:

\[ \text{TA}_x = \text{TL}_x; \quad \text{TA}_y = \text{TL}_y; \quad \text{ND}_y = \text{VD}_x; \quad \text{ND}_x = \text{VD}_y. \]

Assume that the customers holding deposit accounts at banks X and Y engage in transactions that are paid for using deposit money held with the commercial banks. For simplicity, assume that the transactions between customers of the two banks on any given settlement day result in a net transfer of deposits from the customers of bank Y to the customers of bank X equal to four monetary units.
### Table 1. Effects on Bank Balance Sheets of Settling Payments—Two Commercial Banks

#### I. Initial Balance Sheets

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#### II. Effects of Transactions on Balance Sheets

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Interbank settlement using nostro and vostro accounts and effects on the banking system's balance sheet are illustrated in Part II of Table 1. The example is based on the theory that commercial banks establish limits on the amounts they are willing to hold in their mutual accounts with each other. These limits are determined, in part, by interbank risk assessments, as the nostro bank assumes some credit risk from holding deposits with a counterparty vostro bank. In addition, however, nostro banks are profit maximizers and will seek the highest possible rate of return on investments, consistent with their need to hold clearing and settlement accounts. Nostro banks will therefore attempt to optimize the amount of reciprocal balances they hold, allocating the largest part of their portfolios to other assets including loans and securities.

Panel A of Part II of Table 1 illustrates the effect of a transfer of four monetary units' worth of deposits from the customers of bank Y to the customers of bank X (DD\textsubscript{y} is decremented, whereas DD\textsubscript{x} is incremented, by four monetary units). Where bank X is willing to accept payment from bank Y in the form of an increase in its vostro account, bank X's nostro deposit asset and bank Y's vostro deposit liability are each increased by four monetary units (VD\textsubscript{x} + 4 = ND\textsubscript{y} + 4). The total assets and liabilities of bank Y do not change, but those of bank X increase by four. Essentially, bank X has made a loan to bank Y and there is a total increase in the banking system's resources of four monetary units.

Panel B of Part II illustrates a case in which bank X is unwilling to increase its vostro deposits with bank Y. The alternative form of settlement illustrated is a reduction of bank Y's nostro debit with bank X (ND\textsubscript{x} - 4 = VD\textsubscript{y} - 4). Bank X's unwillingness to increase its nostro deposit with bank Y and bank Y's unwillingness, or inability, to transfer other liquid assets from OA\textsubscript{y} to bank X has the result of reducing the banking system's total resources by four monetary units.

Panel C illustrates the case in which bank Y settles its interbank obligation with bank X for the transfer of four monetary units of customer deposits by a shift in other assets. For example, bank Y may simply pay bank X in cash, which reduces bank Y's total resources by four monetary units, increases bank X's total resources by four monetary units, and leaves the resources of the total banking system unchanged.

In practice, some vostro banks become highly specialized in the role they perform and therefore strongly influence the operation of interbank settlements and the money market. The importance of vostro banks in the money market is directly related to their dominant position in the payment system. In addition, however, the role of the central bank in the interbank payment process and the central bank's policies on the minimum reserve requirements it establishes and the payment credit it grants are key determinants of money market conditions. The role of the central bank in the interbank payment system and the interplay between the...
Role of the Central Bank in Interbank Settlement

In a complex banking system with many participants, it is inefficient for banks to establish large numbers of bilateral relationships and to hold many nostro accounts. Maintaining nostro accounts can be expensive, as the vostro banks will assess fees for the account and payment services they provide. More important, however, nostro accounts can absorb large amounts of liquidity when nostro banks try to maintain the precautionary balances needed to settle obligations and to meet minimum balance requirements established by vostro banks. Accordingly, there is a finite limit to the number of nostro accounts that banks will want to hold, which stimulates competition among the vostro banks.

However, every bank must be prepared to satisfy its customers' needs to send money to or receive money from any other economic actor holding an account at any other bank in the system. This calls for a specialized, central institution that provides account services to virtually the entire banking system. This, of course, is an important role of the central bank.

In the banking vernacular introduced earlier, commercial banks hold nostro accounts with the central bank. The central bank, however, does not hold nostro accounts with commercial banks, at least not with respect to its domestic currency. The central bank is a very important vostro bank because it holds accounts for almost the whole banking industry.

The nostro accounts that commercial banks hold with the central bank can be used to make interbank payments using "central bank money." Payment using central bank money is a unique form of payment, because such payments result in a claim on an institution that cannot fail and that, because of its money creation powers, will never suffer a shortage of liquidity. Consequently, recipients of payments in the form of central bank money assume no counterparty credit or liquidity risk. Moreover, payments made with instruments issued by the central bank are completely convertible, because all banks hold accounts directly with the central bank that they use to settle interbank payments or with vostro banks that themselves use central bank payment services.

The central bank establishes terms and conditions for the vostro accounts it provides. Balances held in central bank vostro accounts are almost always noninterest bearing. Further, many central banks establish

2Central banks in different countries maintain account relationships with each other. Further, central banks may also hold balances with commercial banks overseas in connection with the management of their foreign currency reserves.
minimum reserve requirements that commercial banks must meet, at least in part, by maintaining balances in their nostro accounts with the central bank. Central banks may also charge explicit fees for their payment services. Further, central banks can provide liquidity to individual commercial banks by granting central bank credit, which contributes significantly to the efficiency of a nation’s payment system and is an important element in determining conditions in the domestic money market. By using central bank credit when liquidity is tight, commercial banks can ensure completion of payments on schedule. In a modern payment system, central bank daylight credit is especially important as a source of intraday working capital to banks. Short-term “daylight loans” to banks by the central bank, if not repaid by the end of the day, become overnight loans. Thus, there is a direct connection between a central bank’s providing intraday credit and the management of its Lombard facility.

In a generalized model of the banking system, commercial banks that hold nostro accounts with the central bank should be divided into two groups—those that are eligible to use central bank credit and those that are not. In some countries, for example, certain classes of banking institutions, such as savings banks or bank-like institutions that are not required to hold reserves, may not be granted direct access to central bank credit. In any event, central bank credit to banks with access to this source of liquidity will be rationed, either by price or administratively.

Table 2 illustrates an example of the effects on balance sheets of the central bank and two commercial banks as a result of customer transactions. The notation is the same as that used in Table 1, with the following additions:

- **BL** = loans by the central bank to commercial banks;
- **CC** = currency and coin liabilities of the central bank;
- **GS** = government securities investments of the central bank;
- **RA_x** = reserve account balances held by bank X with the central bank; and
- **RA_y** = reserve account balances held by bank Y with the central bank.

The nonbank public’s payment transactions are the same in this example as in Table 1 for a banking system consisting only of two commercial banks.

Part I of Table 2 shows the initial balance sheets of the central bank and commercial banks X and Y. In this example the central bank acts as a vostro bank and the two commercial banks hold nostro accounts **RA_x** and **RA_y**, respectively, with the central bank. The central bank also makes loans to commercial banks and does so directly by creating an asset BL.

Panel A of Part II illustrates the case in which bank Y settles its interbank obligation to bank X associated with the transfer of four monetary units of deposits from bank Y’s customers to bank X’s customers. The
Table 2. Effects on Bank Balance Sheets of Settling Payments—
Central Bank and Two Commercial Banks

I. Initial Balance Sheets

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<th>CENTRAL BANK</th>
<th>BANK X</th>
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<td>GS ( R_A )</td>
<td>( D_D )</td>
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<tr>
<td>BL ( R_A )</td>
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<td>TA ( T_L )</td>
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II. Effects of Transactions on Balance Sheets

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<tr>
<td>CENTRAL BANK</td>
<td>CENTRAL BANK</td>
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<td>GS ( R_A + 4 )</td>
<td>GS ( R_A + 4 )</td>
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<tr>
<td>BL ( R_A - 4 )</td>
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<td>TA ( T_L )</td>
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<th>BANK X</th>
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The liability sides of the commercial banks' balance sheets are affected by the now familiar decline in \( D_D \) and the increase in \( D_D \). To settle the customer payments, bank \( Y \) orders a transfer from its central bank nostro account, \( R_A \), to the central bank nostro account of \( R_A \). In this case, there is no change in the banking system's total resources, as bank \( Y \) transfers an existing asset to bank \( X \). The effect is virtually identical to that explained earlier when bank \( Y \) paid bank \( X \), using cash, as shown in Panel C of Part II of Table 1.

Panel B of Part II of Table 2 shows the effects of using the central bank for interbank settlements when bank \( Y \) has insufficient funds in its central bank nostro account to meet its interbank settlement obligation to bank \( X \). In this case, bank \( Y \) must borrow from the central bank in the amount of
the settlement obligation, resulting in a new liability for bank Y, \( BL_y + 4 \). By agreeing to make the loan and transfer the proceeds to bank X, the central bank creates additional loan assets and would increase total reserves by four monetary units, unless it undertook an offsetting open market sale of assets of equivalent value. The banking system’s total reserves now equal \( RA_y + (RA_x + 4) \).

### The Payment System and the Money Market

The interplay between the central bank’s credit policies and those of commercial vostro banks determines money market conditions. An example might help illustrate this point.

Suppose that two banks, A and B, both hold nostro accounts with the central bank. As a result of its customers’ payment activity, bank A faces a deficit in its nostro account, or at least is unable to keep its balance at the level necessary to satisfy its minimum reserve requirement. Bank B, however, holds excess reserves in its account, above the amount needed for settlement and to meet reserve requirements. Banks A and B can enter into a mutually beneficial loan of reserve balances if B charges A a lower rate of interest on an overnight loan than would the central bank. The interest rate charged by B will be between the rate it earns on its excess reserves (zero) and the rate charged by the central bank for overnight loans. Or, if the central bank sets the Lombard rate administratively and rations credit, B will charge a rate that is not high enough to induce A to overcome its reluctance to approach the central bank for a loan.

The situation with intraday funds is different because in most countries there is no market for intraday credit. In principle, however, intraday markets should operate like overnight markets, with reserves being allocated between banks’ nostro accounts with the central bank depending on conditions of supply and demand.³

Whereas overnight central bank credit is well understood, intraday credit is a fairly modern phenomenon that has resulted from the emergence of new kinds of markets characterized by very high volumes and values of transactions that must be settled quickly. Examples include the markets for government securities, other financial instruments, and financial derivatives. Participants in these markets find it difficult to synchronize incoming

³An intraday market does exist in Japan for funds that settle at the three designated settlement times in the Bank of Japan Financial Network System (BOJ-NET)—a designated-time net settlement system. The Federal Reserve began charging explicit interest for intraday overdrafts in April 1994, a measure that could stimulate the development of a private market of some type for intraday funds in the United States.
and outgoing payments and therefore have a special need for bank intraday credit.\textsuperscript{4}

As in other kinds of markets, participants in the high-value securities markets rely heavily on bank services to meet their payment needs. Activity in these markets therefore gives rise to interbank payments that have special characteristics, such as rapid settlement. Because a given security may be traded several times on the same day, the payments associated with each trade must settle within that day. The special settlement requirements of the high-value financial markets have greatly increased the value of intraday, interbank transfers and have led to very rapid turnover in the reserve balances that commercial banks keep with the central bank. To cite but one example, in the United States, the ratio of average daily payments settled on the books of the 12 Federal Reserve Banks to average daily reserve balances maintained has increased dramatically, from only about 1 in 1960 to over 30 in 1985, and over 60 by 1992. This rapid turnover in balances held in central bank nostro accounts explains the dramatic increase in intraday credit and the emergence of intraday credit as a major bank management issue.

Increasingly, the method used by central banks to supply interbank payment and settlement services while controlling their own risk is through large-value transfer systems. Although, as discussed in Chapter 6, these systems can be designed in different ways, the tendency is toward gross, real-time systems that provide final settlement. Such systems are flexible enough to support many types of interbank payment needs, including intraday or immediate settlement for financial market deals and settlement obligations resulting from netting performed by specialized clearing organizations.

A bank's payment system operations directly influence how it manages its cash position. Cash management is defined as those operations undertaken to regulate and control the assets a bank holds to make payment. The cash position of a bank is defined as the sum of three major items: (1) the balances in the bank's nostro account held with the central bank; (2) the balances in the bank's nostro accounts held with other commercial banks; and (3) the bank's holdings of domestic bank notes and coins. The objective of cash management is to keep the optimum amount of cash. The cash balance should be enough to satisfy the settlement obligations that arise from the payment behavior of the bank's clients and minimum balance requirements that may be set by the vostro banks, but not more than is needed for these purposes. In general, because cash is a sterile asset, cash managers will strive to keep on hand only what is absolutely necessary.

Any surplus cash will be channeled to the money market. The major determinants of the cash positions that banks maintain are the volume and price conditions imposed by vostro banks, especially the central bank. The operation of a large-value transfer system is the primary channel through which central banks provide intraday credit. In this connection, and as discussed in Chapter 4, the conditions surrounding the demand for and supply of intraday credit have direct implications for short-term interest rate determination, including not only intraday rates but also the overnight rate. Accordingly, use of central bank accounts and credit to meet settlement obligations in connection with payment activity can have direct implications for interest rate determination in the overnight and 24-hour markets.

Payment System Hierarchy

The foregoing discussion suggests a payment system hierarchy that has been described as an "inverted pyramid." At the top of the inverted pyramid is the broad base of economic actors whose daily activity in the market economy gives rise to payment obligations. This base consists of individuals who use retail payment services provided by banks, and a variety of business enterprises in the goods and services industries. The next level includes very specialized firms, such as brokers and dealers, involved in the money, capital, and commodities markets, which also rely on bank payment services.

All of the economic actors in the base of the inverted pyramid have one thing in common: they incur payment obligations and rely on banks for the services that allow them to discharge those obligations. But they may, either knowingly or unknowingly, rely on some type of clearing organization to clear and settle their transactions through the banking system. In any event, by using banks' services, their economic activity, in turn, leads to the banks' assuming interbank settlement obligations.

As described earlier, interbank settlement can occur between the commercial banks themselves, using nostro and vostro accounts, shown in the next narrower level of the pyramid. Finally, at the very pinnacle, is the central bank. The central bank holds accounts for virtually every commercial banking institution and serves as the ultimate settlement authority because it provides final interbank settlement in central bank money. Final settlement in central bank money is usually effected using a large-value transfer system operated by the central bank.

Conclusions

The banking system, consisting of commercial banks and the central bank, is the instrumentality through which payments are made in a developed market economy. Commercial banks provide settlement accounts and the liquidity needed to meet their customers' needs in making payments. Interbank settlement occurs through interbank account relationships, and of special significance in this regard are the nostro accounts that commercial banks hold with the central bank. It is through these nostro accounts that commercial banks achieve final settlement using central bank money. The operation by the central bank of a real-time gross settlement system for making large-value payments is the chief operational mechanism for effecting interbank settlement in central bank money.