

The Future of Real-Time Gross Settlement: The Role of the Central Bank

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1 Introduction

This paper identifies and assesses some policy issues arising from central bank experience and practice in supporting real-time gross settlement (RTGS) systems, both as settlement authorities and as service providing RTGS system operators. A decade of experience with RTGS across financial systems in different stages of development, in an increasingly globalized marketplace, has revealed a number of practical problems for both central banks and the direct users and other beneficiaries of RTGS services. The practical issues are highlighted by variations in practice in the areas of RTGS access, liquidity and credit, and costing and pricing, variations that at times belie the common understanding that has been assisted by the Committee on Payment and Settlement Systems (2001) core principles for the design and operation of systemically important payment systems. By identifying practical policy issues, we hope to motivate operationally concrete responses by individual central banks to system-specific problems, and by consortia of central banks to multi-system problems that may call for harmonized approaches.

The World Bank Group (2008) recently surveyed 142 central banks about their national payment systems. The survey included questions about national large-value and RTGS systems, and also about settlement arrangements for securities and foreign exchange that rely on RTGS systems for final settlement. The central bank respondents indicate that an RTGS is a feature of their national payment systems in 112 of the 142 cases. The central bank is the settlement authority for every RTGS system, and the RTGS system is operated by the central bank in 108 cases. Some countries share RTGS platforms and altogether the survey identified 98 distinct systems. The survey results suggest that central bank operational principles and practices vary greatly across these systems in the areas of access, liquidity and credit, and costing and pricing.

This assessment relies on the World Bank survey results and on other published information on RTGS principles and practices. This published information is supplemented by detailed information we have collected for six RTGS systems representing both large and smaller financial economies, and economies in different stages of development: Australia, Colombia, the Eurozone, Norway, the U.K., and the U.S. The detailed information on RTGS policy and practice for the six "reference countries" was collected using the questionnaire shown in the Appendix, with the assistance of the responsible central banks. While primarily illustrative, the

sample across the six reference countries allows for meaningful comparative analysis at the level of operational detail that has an important influence on the experience and behaviors of both the RTGS system providers and users. The detailed sample also sheds light on the importance and challenge of gauging RTGS practices at the level experienced in day-to-day operations.

Our assessment distinguishes between four operational modes of access: to settlement accounts only; to settlement accounts and central bank credit; to authority to order transfers as an agent on behalf of the owners of settlement accounts; and, indirectly to RTGS services through account holders. Our premise in considering RTGS liquidity and credit provisioning practices is that central bank intra-day and overnight lending policy and practice should be harmonized and rationalized, and our assessment focuses on the alignment of policy and practices in these areas with the needs of RTGS participants on the one hand, and central bank risk managers, on the other. Further, the RTGS is examined as a single point of failure across the entire financial system, in that participants face liquidity impacts from all of their DVP and PVP links, as well as settlement links to clearing houses and other elements of financial markets infrastructures, sometimes in multiple countries and currencies simultaneously.

With regard to costing and pricing, we lay out a full RTGS production and cost function model that includes 1) administering settlement (reserve) accounts, 2) provisioning credit and managing risk, and 3) providing funds transfer services. Using this model, we distinguish between RTGS operations that are governmental in nature and those that are more characteristic of private financial services. Our assessment draws out the implications for public policy in developing economies that have yet to establish RTGS systems or that process low volumes of transactions, and in developed economies whose central banks are struggling to meet cost recovery mandates for the services they provide.

Section 2 addresses eligibility to use RTGS services. Section 3 addresses liquidity and credit policies in RTGS systems. Section 4 addresses RTGS costs and pricing. Issues for consideration by central bankers and other RTGS stakeholders are presented at the end of each section.

2 Eligibility to use RTGS services

This section deals with central bank practices and policies related to access to RTGS services and is organized into four main parts. Part one reviews key concepts and provides an analytical framework for assessing RTGS access policy. Part two reviews the body of knowledge and central bank policy concerning access to RTGS. Part three assesses the current state of access to RTGS systems and reviews the approaches taken in the six reference countries. Finally, part four identifies and discusses issues relevant to central banks reviewing their access policies.

2.1 Key concepts and analytical framework

Real-time gross settlement systems offer a rich set of banking-related services that provide value throughout the financial and real sectors of the economy. Bank and non-bank financial institutions, commercial and industrial firms, and even individuals benefit from use of RTGS services. The terms and conditions under which access to RTGS services is granted have an important bearing on how effectively and efficiently an RTGS system supports the financial and real sectors of the economy. Moreover, the terms of access affect the abilities of the providers and users of RTGS services to manage their payment system risks.

The set of RTGS services can usefully be categorized into two principal groups – settlement account services and settlement credit services, referred to by the designations SA and SC, respectively, in Table 1. The settlement is "ultimate settlement" in central bank money with finality. An additional category of access-related service is the authority granted to a third party to order account balance transfers in an agency capacity on behalf of the account holder, with the designation of AA in Table 1.

The provision of settlement accounts entails closely related operational services including transfers of balances from and to accounts (funds transfers), account maintenance, account management tools including balance information, the hours of operation of the system, interoperability with other systems by means of standard formats (including PVP and DVP systems), and the like. Credit services include the extension of central bank intraday and overnight loans, made by crediting settlement accounts, and the associated lending terms (for example, lines of credit, rates charged, and collateral requirements). In considering access to

RTGS systems, it is important to distinguish carefully between account services and credit services.

Access to RTGS systems is defined first by the terms governing who is permitted to hold a central bank settlement account, and then by the terms governing which account holders can obtain central bank credit. An entity may have direct access to a settlement account and to credit, or alternatively direct access to a settlement account only with no access to central bank credit. If the terms of access deny an entity a settlement account relationship with the central bank, then that user gains access to RTGS settlement and associated operational services only indirectly as the customer of another entity that holds a settlement account directly. Accordingly, there are four basic types of access to RTGS services: direct access to a settlement account and credit; direct access to a settlement account but not to credit; authority granted to an agent to order transfers on accounts owned by others; and indirect access to RTGS services through a customer relationship with a direct RTGS system account holder, who sends and receives transfers “on behalf of” the customer. In practice, we have found it useful to define seven types of entities for purposes of analyzing the information collected for the six selected central banks. As shown on Table 1, these are deposit institutions, investment banks, insurance companies and pension funds (broadly non-bank financial institutions), financial market central counter-parties (CCPs), financial market settlement agents, retail market settlement agents, and non-financial companies.

The concept of tiered RTGS access is closely related to the traditional tiered structure of account relationships in the correspondent banking system, whereby correspondent (or *vostro*) banks provide account, credit, and settlement services to downstream respondent (or *nostro*) banks. The banks serve as the gateway to payment system settlement for non-banking firms, individuals, and non-resident banks. The central bank sits at the apex of the correspondent banking pyramid and its deposit liabilities are the preferred settlement medium for large-value transfers, due to their unique attribute as a riskless monetary asset.¹ In fact, the majority of RTGS systems around the world are operated by central banks and settlement takes place using central bank money.² Generally speaking, there are relatively fewer participants in the ascending

¹See Blommestein and Summers (1994).

² See World Bank Group (2008).

tiers, and the structure of RTGS access, like the correspondent banking model, resembles a pyramid.

Also, in practice, many financial institutions and some large non-financial firms understand the significance of RTGS operational and credit services that banks receive from the central bank, and actively seek the benefits of finality using central bank money. Often, bank customers specify that the RTGS system be used to receive, send, and settle their business and/or individual payment transactions.

2.2 Development of central bank policy and practice

In the early 1990s economic and policy analysis was applied to the markets for payment services and the role of the central bank in the payment system. This analysis was stimulated in part by heightened appreciation of the risks involved in payment systems, the role of central bank money in ensuring interbank transactions, and by the cooperative efforts of central banks and international financial institutions to assist policy makers in emerging market economies design and develop their payment systems. Access to the payment system, and in particular to central bank settlement services, has been a prominent consideration in the transition from planned and socialist economies to modern market economies, and in financial system development more generally.

The nature and extent of access to central bank services was identified by Marquardt (1994) as an important factor influencing the efficiency of the payment system. This analysis concluded that a policy of wide access to central bank services for institutions offering deposit money accounts would promote efficiency. The analysis noted that potential frictions in the correspondent banking system, for example, the bundling of services and resulting restrictions on respondent bank choice in the use of settlement services, and conflicting correspondent bank objectives related to the time value of money that could inhibit the speedy clearing and settlement of payments, argued for broad access to central bank accounts. In addition, a broad access policy was seen as promoting a more competitive banking system by reducing concentration in the top tier of access to central bank services.³ While adhering to the model

³ This analysis of the efficiency aspects of access to central bank services also addressed the issue of incentives for efficient use of central bank services. In general, if central banks subsidized the use of their services by providing

wherein central banks provide access only to deposit-taking institutions (banks), this analysis also challenged correspondent banking practices that result in a concentration of settlement accounts with the central bank.

Also at this time, Spindler and Summers (1994) assessed the role of central banks as operators of large-value payment systems in the context of the broader role of the central bank in a nation's financial system. This assessment stressed the "safety net" attributes of central bank RTGS services through the provision of final settlement in central bank money. By virtue of its RTGS system access, a troubled financial institution whose creditworthiness is questioned by its counterparties would continue to be able to participate in the financial markets pending an orderly resolution of its difficulties, because the counterparties would have confidence in the payments they received. This assessment of access to central bank settlement through the RTGS system stressed the nexus between the central bank's settlement, credit, and in many cases supervisory roles.⁴

During the 1990s the international community of central banks, through the Bank for International Settlements (BIS), focused public policy attention on the operation of large-value and "systemically important" payment systems. Their efforts resulted in the CPSS (2001) core principles governing systemically important payment systems. These principles have become the accepted yardstick for assessing the quality of national RTGS systems and cross-border, large-value payment systems. Principle IX addresses access and states "The system should have objective and publically disclosed criteria for participation, which permit fair and open access." Besides fairness, openness, and policy transparency, however, the CPSS access principle provides little concrete policy guidance about the nature and structure of access to central bank settlement accounts and credit. In particular, there is no policy guidance on who or what type of institutions should have direct access to settlement accounts and credit. A brief examination of the reasoning behind Principle IX, together with other related BIS analysis, is necessary to provide insight into the thinking and intent of central banks on the more practical questions relating to RTGS access.

access at a price below the cost of production, services might be over used or not used in an efficient manner, thus tending to erode the other efficiency benefits of broader access.

⁴ The interlocking roles of the central bank as lender-of-last-resort, payment and settlement service-provider-of-last-resort, and supervisor of institutions having access to RTGS is developed further by Summers (1997).

The CPSS core principles are based on objectives of payment system safety and efficiency. The principles envision payment systems whose attributes include crime prevention, competition, and consumer protection. Because the core principles are meant in the first instance to apply to systemically important payment systems, the objectives of safety and efficiency should be thought of principally in the context of the money and capital markets and the needs of participants in those markets.

The CPSS core principles explicitly recognize the tiered structure of settlement and the important influence of central bank access policy on the settlement needs of economic actors who have different types of access. The implications of tiered settlement for large-value payments are explored not in the context of access policy, however, but rather in the context of safety and central bank preferences for the settlement medium to be used (in the context of Principle VI which states “Assets used for settlement should preferably be a claim on the central bank; where other assets are used, they should carry little or no credit risk and little or no liquidity risk.”). Regarding the structure of settlement and the closely related questions of who can hold a settlement account with the central bank and who can obtain central bank credit, the report recognized in the discussion of access the importance of domestic legal arrangements and the structure of the domestic financial system. In fact, the report references the lack of international consensus about access for non-bank financial institutions, especially securities firms. Clearly, the central bankers developing the core principles were balancing a number of considerations concerning access policy. On the one hand, they saw value in the use of settlement assets that eliminate or minimize credit and liquidity risks, while on the other hand they recognized that local laws and customs might limit the use of central bank money for settlement.

Two CPSS reports published after the core principles provide some additional insight into central bank thinking about access to RTGS systems. The CPSS (2005) review of new developments in the operation of large-value payment systems links access policies to the basic objective of protecting large-value payment systems from risk. Like the report containing the core principles, financial risk is highlighted, although operational and legal risks are also referenced as important safety considerations in establishing access policy. The discussion of new developments hones to the traditional correspondent banking model in noting that those financial institutions which are not permitted to hold accounts with the settlement authority (that

is, the central bank) may only have indirect access to RTGS services. Finally, the report recognizes that change in the structure of the financial markets is a factor that ought to influence the future development of RTGS system policies.

The CPSS (2006) provides guidance in the development of national payment systems. While access to payment and settlement arrangements receives only limited attention, it is notable that influencing access to payment systems is seen as an aspect of the central bank's role as a catalyst for change. In this connection, the paper states that banks "and other similar financial institutions" should have direct or at least effective indirect access to any clearing and settlement facilities provided by the central bank. This report continues to reflect the tension that central bankers feel regarding access and attainment of other desired safety and efficiency objectives.

2.3 Current state

The World Bank (2008) collected information about the rules that govern access to RTGS systems and about the broad types of participants allowed access under the rules. The system rules are explicit about who is allowed access for 84 of the 98 systems, and objective criteria are used to gauge eligibility for 58 of the 98 systems. Also, the RTGS system rules formally provide for the central bank operator to exclude an entity from participating, even if it does comply with the admission criteria, in 80 of the 98 systems. Thus, the majority of central bank RTGS systems comply with the main thrust of Principle IX, which stresses transparency and explicit participation criteria. The World Bank survey results show that such compliance is widespread across all country classes as defined by geographic region, national income levels, and country population size.

Non-banks are reported to have direct access to 64 of the 98 RTGS systems, and among these the direct access is limited to settlement accounts only with no access to central bank credit in 42 systems, leaving 25 of the 98 systems also providing non-banks access to central bank credit. The World Bank report speculates that the types of non-bank institutions that have direct access only to settlement accounts consists of clearinghouses, card processing companies, stock exchanges, securities depositories, and the like. By inference, non-bank institutions that have direct access to settlement accounts and credit would likely consist of firms that are active in the financial markets, for example, investment banks. Overall, the World Bank survey results

indicate that broad access to settlement accounts and credit by non-banks is relatively more prevalent in higher-income countries, especially in the Eurozone.

An observation made by the World Bank that has significance for current and future central bank access policy is that in several cases the RTGS system is expressly designed to handle both large- and small-value transactions. That is, the national payment system design calls for gross settlement in central bank money and in real-time for financial market, commercial, and retail payments. Indeed, the World Bank envisions that an increasingly number of countries will respond to technological advances by designing their payment systems to allow for all payments to be made via the RTGS system.

The current state of central bank practice regarding RTGS access has recently been addressed by Lindley (2005) and Heller (2007). Unfortunately, neither distinguishes between access to settlement accounts and credit. With this limitation in mind, the presentations are clear that commercial banks always have access to RTGS systems, that central governments almost always have access, and that non-bank securities firms often have access. These observations are broadly consistent with the findings of the World Bank survey. Further, other types of non-bank financial institutions sometimes have access (presumably to central bank accounts), while business corporations and the general banking public almost never have access.

Lindley suggests that the trend is for access rules to be tightened or restricted for most of the classes of participants covered, with the exception of non-bank financial institutions including securities firms. (Granting access to a wider range of bank-like institutions may be a response to changes in national banking structures that result in a blurring of distinctions between commercial and investment banking.⁵) Like others before, Lindley and Heller state that there are no clear rules to guide how access to the use of central bank money should be determined, and that in the end, the proper balance between reliance on commercial and central bank money for settlement is a matter of individual judgment. This said, Heller offers that “open access” is to be preferred if such a policy is supported by carefully designed systems that differentiate access according to class of participant.

A practical assessment of the participant and systemic financial risk issues associated with access to large-value transfer systems in the U.K. is provided by Harrison et al (2005). This

⁵ Kohn (2008) provides a very current perspective on the increasingly similar risk profiles of large banks and securities firms, and the financial safety net implications of these similarities.

is an official assessment undertaken by the Bank of England's financial stability function, in response to a review by the International Monetary Fund (IMF) of U.K. large-value payment systems according to the CPSS core principles. The IMF review cited the risks associated with highly concentrated direct access to both CHAPS and CREST settlement among a relatively small number of institutions (the risks cited by the IMF included operational, financial, and legal risks). Harrison et al conclude that under "normal conditions" the financial risks to first tier (correspondent) participants from exposures to second tier (respondent) participants appears to be low, but that under certain "extreme assumptions" could lead to a significant increase in the credit risk faced by the first tier settlement banks.⁶

Another well documented current development relevant to the state of RTGS is the Federal Reserve's practical assessment of the usefulness and operational efficiency of funds transfer message formats across the chain of large-value transfer systems used by businesses.⁷ In response to requests from the business community, the Federal Reserve is seeking input on possible changes to the Fedwire message format to include structured business remittance information.⁸ If implemented, the new message formats would support the transmission of 20 to 30 business remittances with each payment. The proposal is being made in concert with the private sector organization The Clearing House Company and applies to the Clearing House Interbank Payments System as well as Fedwire. This example is of interest because it illustrates

⁶ Both the IMF review and the Bank of England response focus only on credit risk to the correspondent banks acting as direct access settlement participants on behalf of their respondent bank indirect access participants. This one directional view is presumably motivated by the concern with systemic risk caused by the failure of large financial institutions, a concern which underlies the BIS core principles. There is, however, another type of systemic credit and liquidity risk, namely, that posed to the respondent banks through the failure of a large, direct access settlement participant. An unasked "what if" question concerns the implications of broadly transmitted credit and/or liquidity risk from one or more direct access participants to the population of respondent banks and other indirect access participants such as clearing organizations and investment banks. This type of risk is illustrated by the 1974 failure of Continental Illinois National Bank in the United States. Continental served as a large correspondent bank and gateway to the interbank payment system, and a major financial stability consideration at the time of its failure and intervention by bank regulatory authorities was concern about the financial standing of the large network of respondent banks.

⁷ See Federal Reserve Financial Services (2008).

⁸ Another component of the proposal is to change the message format to provide for full transparency regarding the ultimate originator and beneficiary of a cover payment (that is, a payment made to facilitate an international transaction). This part of the proposal is motivated by money laundering and law enforcement concerns.

that central banks can have a strongly proactive and practical interest in the efficiency benefits of their services to participants having only indirect access to RTGS.

Our attempts to understand how central banks have acted on Principle IX began with the results to the World Bank survey, and led us to probe more deeply into the practices of six reference countries for which access to RTGS settlement accounts and services is shown in Table 1. As noted earlier, the findings depicted in the table are not meant to be definitive, but rather to provide insight into actual practice across a diverse group of central banks. The exercise underscores for us the challenge of collecting meaningful comparative information in light of the richness and differences among the various banking systems. This said, Table 1 provides insights that help flesh out the current state of central bank practice regarding RTGS system access policy and that highlight differences that have policy implications.

Table 1

Access to RTGS Settlement Accounts and Services in Six Selected Countriesⁱ

(DRAFT 10/28/2008)

SA = Settlement accountsⁱⁱSC = Settlement accounts and creditⁱⁱⁱAA=Account authority^{iv}

NO = No access

NA = Not applicable

	Deposit institutions ^v	Investment banks ^{vi}	Insurance companies & pension funds	Financial market CCPs ^{vii}	Financial market settlement agents ^{viii}	Retail market settlement agents ^{ix}	Non-financial companies
Australia	SC	NO	NO	SC	SC	AA	NO
Colombia ^x	SC	SC	SC	SA	NA	SA	NO ^{xi}
Eurozone	SC	SC	NO	SC	SC	AA ^{xii}	NO
Norway	SC	SA	NO	NO	NO	NO	NO
United Kingdom	SC	NO	NO	NO	AA	AA	NO
United States	SC	NO	NO	NO	AA	AA	NO

ⁱ The table shows current practices taking account of legislative parameters and other factors, including discretionary decisions made by central banks. Central bank money is used for settlement in all six cases. Central banks operate the RTGS in every country. In the case of the U.S., two Federal Reserve Bank services, Fedwire and Net Settlement Service, are considered part of the RTGS system.

ⁱⁱ This category represents direct ownership of a central bank account.

ⁱⁱⁱ This category represents direct ownership of a central bank account with contracted rights to borrow central bank funds under prescribed terms and conditions for credit to the account.

^{iv} This category represents authority to order account balance transfers as agent on behalf of account holders, for example, to effect a net settlement.

^v "Deposit institutions" exercise bank-like functions and are subject to official supervision.

^{vi} "Investment banks" rely on their own capital and borrowed funds to engage in financial market dealing, and include broker-dealers and securities houses.

^{vii} "Financial market CCPs" assume counter-party obligations in systemically important net settlement arrangements.

^{viii} "Financial market settlement agents" perform an administrative role by calculating positions in net settlement arrangements, and representing the arrangement to the ultimate settlement authority.

^{ix} "Retail market settlement agents" play the role defined in footnote vii for small-value, retail payment systems.

^x Legislation gives the Banco de la Republica broad discretion to provide settlement services to any entity, public or private, and all financial institutions that are granted access are subject to official supervision.

^{xi} Third-party processors of social security payments that have accounts for settling net positions in the ACH are a unique exception.

^{xii} Responsibility for domestic settlement arrangements is at the level of the National Central Banks.

Among the six reference countries, the central banks in Colombia and the Eurozone have explicit legal authority to offer payment services to a wide range of institutions beyond deposit institutions. In both cases the legal authority has been established fairly recently, at a time during which the types of financial institutions providing traditional banking services have been expanding. Also in both cases, the RTGS system access policy reflects that the legal powers have been used to construct a broad access policy, in both cases providing access to accounts and credit to investment banks and in the case of Colombia to other types of non-bank financial institutions as well. In the U.K., the Bank of England's charter gives the central bank wide powers to pursue its objectives. With regard to access to central bank settlement accounts, however, the Bank has exercised its discretion very narrowly.

In all six reference countries direct access to the RTGS system, including credit, is provided to deposit institutions, while non-financial institutions do not have access. This result is no surprise in that it follows directly from the traditional correspondent banking practice. Perhaps notably, however, for Colombia, the one case where the central bank has virtually unlimited legal authority to grant access across classes of institution, the central bank has agreed to provide settlement accounts to third party processors of social security payments, allowing non-financial institution processors to concentrate these payments from individuals and firms, and then transfer the funds to the social security administrators, for example, pension fund and health service administrators (the transfers are made to commercial banks that hold the accounts of the administrators). The central bank agreed to provide this access following action by the social security administration to place greater operational reliance on the processors for payment services.

Table 1 reveals a range of practices among the six reference countries regarding RTGS system access for the CCPs that are the core settlement institutions for certain systemically important financial systems, especially futures and options exchanges. Only Australia, Colombia, and the Eurozone provide direct RTGS system support, the former and latter in the form not only of accounts but credit as well. Norway, the U.K., and U.S. have not provided access and the CCPs in these countries settle their obligations through commercial banks. In the U.S. at least, there is the option of providing access to a non-bank financial institution through

the issuance of a special purpose bank charter, but this path has not been taken with regard to the CCPs.

Most of the central banks in the six reference countries, however, have found ways to provide RTGS support to both financial market and retail market settlements by accommodating the settlement agents that represent and administer the interests of the members of formally constituted net settlement groups. Even when accounts and credit are not provided to settlement agents, most central banks (Norway being a financial market and retail market exception), allow settlement agents to order the transfer of funds from and to the accounts of the members of the net settlement arrangements in line with payment agreements shown on a "settlement sheet."

2.4 Issues for consideration

The principal goals of the international central banking community in offering RTGS services are to increase safety and efficiency in systemically important payment systems, thereby serving the wider objectives of large-value payment systems across the financial markets and the real economy. Access to RTGS systems, however, varies quite widely in practice. While Principle VI establishes a preference for settlement in central bank money, Principle IX reflects the reality of widely differing practices in many countries with respect to direct access to central bank settlement services.

Information from the World Bank survey and our sample of six reference countries reveals that direct access to RTGS services is not inclusive of the institutions that are responsible for transactions in all systemically important markets in a number of countries, including securities firms and CCPs. The contrasting approaches may be explained in part by a strong link between central bank RTGS system access policy and the traditional correspondent banking model, which has tended to concentrate direct settlement and credit relationships with a relatively narrow group of financial institutions. Further, as discussed in the context of the traditional correspondent banking model and the analysis of practices for the six reference countries, broad access to RTGS services can be at odds with banking laws, structures, and customs that tend to restrict the availability of central bank services.

One conclusion, therefore, is that Principle IX is less concrete and operational than the companion core principles, and that it provides guidance that needs to be operationally clarified and balanced with that provided by Principle VI. Adding concreteness to Principle IX in a

manner that resolves conflicts of intent with other core principles would promote reconciliation in access practices among established RTGS systems. Such reconciliation is especially important to financial institutions that operate globally and participate in RTGS systems in more than one country, sometimes facing different policies in different countries for the same type of business (this global issue is developed further in section 3). It would also help guide central banks in developing financial economies as they evolve their own RTGS system practices, and in particular tackle a practical question that is being raised by World Bank staff concerning the eligibility of RTGS system access not only to accounts but to central bank credit as well, for any institution that is able to meet the central bank's operational and credit rules. Operationally meaningful guidance should make crisp distinctions between access to accounts (and hence to ownership of central bank money), access to accounts and credit, and access to what is referred to in this paper as account authority.

Another issue is the appropriate measure of how wide or "open" access is to RTGS systems. While it is useful for some purposes to know how many institutions participate in a particular RTGS system, sheer numbers are not as meaningful as is the scope across the types of institutions that play important roles in the financial markets. Indeed, as financial markets become more specialized, the number of active players tends to be concentrated among a smaller number of specialized institutions. Accordingly, analysis of the degree to which access to RTGS systems is open should focus on the systemically important categories of transactions in the economy, and then on the institutional types responsible for settlement of these transaction types. The pertinent question in any financial system is, do the institutions with the largest or most significant settlement obligations have access to the RTGS system?

Some central banks designate certain retail systems as systemically important or, as is the case in the Eurozone, as "important systems." The data show that many if not most central banks are devising access rules that make "ultimate settlement" available, at least indirectly, to important retail systems. An issue, then, is the possible need for review of official guidance to ensure that it recognizes the practical response of central banks in extending desirable settlement system safety to large retail systems, by clarifying the role of access in extending ultimate settlement benefits to the retail sector.

3 Liquidity and credit in RTGS systems⁹

The effective functioning, day by day, of every RTGS system depends critically on the adequacy of the liquidity – the immediately usable balances on an account with the settlement agent – available within the day to each of its members to fund its payment obligations and those of its customers. The importance of this truism is shown by the growing number of authoritative reports and studies on aspects of the topic that have been issued by official and private sector bodies in recent years. In considering the topic, it is important to distinguish between intra-day liquidity and end-of-day (balance sheet) liquidity; and between liquidity risks arising in a payment system and funding risks for the system participants.

The CPSS (2001) report on core principles for systemically important payment systems, which is mainly addressed to central banks and other system operators, discusses in Principles II and III the understanding and the management of credit risks and intra-day liquidity risks: Principle III emphasizes the importance, for the efficient functioning of an RTGS system, of both adequate liquidity in the system as a whole and its sufficiently wide distribution among the system members. The CPSS (2003) report on the role of central bank money in payment systems discusses, among other propositions, the ability and the willingness of central banks to extend intra-day credit to participants in RTGS systems. The Basel Committee on Banking Supervision (2008) establishes the principles for sound liquidity risk management and supervision. Although mainly concerned with funding risks for individual institutions (and of interest therefore to their supervisors), the Basel supervisors emphasize in their Principle 8 the importance for each bank of actively managing its intraday liquidity positions and risks to meet its obligations on a timely basis, under both normal and stressed conditions, and thus to contribute to the smooth functioning of payment and settlement systems. The CPSS (2008) further shows how links between two components of any financial market, such as an RTGS system and a Central Securities Depository (CSD), can create a cross-system intra-day liquidity risk – the risk that a

⁹ The discussion in this part of the paper, and indeed the findings of the World Bank survey, assume that financial markets, including the inter-bank markets, are functioning normally. No attempt is made to analyze or to take account of the special temporary measures taken recently by central banks in a number of countries to expand both the loan facilities to banks and the range of acceptable collateral, while permanent additional facilities are included where appropriate.

failure to make a payment through the RTGS system can block a transfer in the CSD (or, of course, *vice versa*), with the potential for consequential impacts on other participants in each system and thence on flows of funds or instruments in the securities and other markets. An RTGS system can thus become a single point of failure for the entire financial infrastructure of its country; the report suggests a series of steps to be taken by system participants and public authorities to understand and address the liquidity and other risks it has identified.

The Institute of International Finance (IIF 2007) makes a useful private sector contribution on this topic. The IIF sets out 44 recommendations of good practices for banks in managing their liquidity, in measuring, monitoring and controlling their liquidity risk, and in stress testing and contingency planning. The bulk of the IIF recommendations address aspects of funding risks, but some are also very relevant to consideration of intra-day liquidity demands, including (Recommendation 32) the need for stress tests to measure the behavior of all sources of cash inflows and outflows that could be material to the bank.

3.1 RTGS liquidity and collateral practices

The world-wide application of at least some of these public and private sector principles and good practices is reflected in findings reported by the World Bank (2008). In 97 of the 98 distinct systems identified by the survey, the central bank settlement authorities grant intra-day credit to their RTGS system participants by way of loans, repos, or current account overdrafts. In 65 systems a further source of RTGS liquidity is the ability of participants to draw down during the day, in full or partially, fixed reserves they are required to hold with the central bank, including reserves held for monetary policy purposes, or deposits required to finance the central bank itself. In only 40 of the 98 RTGS systems do participants make use of lines of credit between banks.

The terms on which central bank credit is available differ quite widely. At one extreme, one central bank requires no collateral, and places no limits on the sums it is prepared to advance to RTGS participants, and three central banks also require no collateral but do impose limits on their advances. In contrast, 82 central banks require high quality collateral in all cases – which, taking account of mark-to-market valuations and haircuts on the securities that participants are prepared to deposit for this purpose, places *de facto* limits on the advances that they can obtain from their central banks.

If RTGS participants do not repay these advances in full by the close of business, 56 of the central banks transform their intra-day advances into overnight credit at penalty rates, while 17 provide the necessary overnight credit at market rates (though those rates may themselves be more penal than official rates, to the extent that they reflect end-of-day market shortages). Thirteen of the central banks immediately seize the collateral that they hold, with a view to both restoring their own positions and negating any impact of unforeseen overnight lending on their monetary policies.

These findings of the World Bank survey are amplified in our more detailed review of the practices in six reference countries, where a broadly consistent approach is apparent. While all these countries provide credit to RTGS members, by way of repo or loan, one key difference between their practices, as set out in Table 2, relates to the imposition of formal limits on their advances. These limits are found only in Colombia and (for uncollateralized credit) in the U.S.; in the other countries the availability of acceptable collateral provides the *de facto* limits on advances from the central banks, although the Bank of England retains a reserve power to apply individual limits.

Banks in Australia and Norway are not required to hold fixed reserves with their central banks; in the remaining countries the banks' required reserves, which are held with the central bank either for monetary policy purposes or (as in the case of the U.K.) to finance the activities of the central bank itself, may be drawn down within the day, provided that they are restored by the end of the business day or over the averaging period, as appropriate. In each of these countries the inter-bank market can be a source of overnight or longer-term funding, though in our experience it cannot always be relied on to produce the sums sought by short banks.

Table 2
Liquidity, Credit, and other Aspects of RTGS Systems

	Australia	Colombia	Eurozone	Norway	United Kingdom	United States
Intra-day Liquidity:						
- Central bank advances						
<i>Available to all RTGS system members</i>	Yes, by repo	Yes, by repo	Yes, by repo with individual NCBS	Yes, by overdraft (interest-free collateralised D-loans)	Yes, by repo	Yes, by uncollateralised intra-day overdraft for credit-worthy institutions (a collateralisation proposal is due to be acted on by year-end)
<i>Limits (in addition to the effective limits created by the availability of acceptable collateral, marked to market and less haircuts)</i>	Unlimited	Limited to 35% of deposits for deposit-taking institutions, and to capital for other financial institutions (w/o LOLR facilities).	Unlimited	Unlimited	Normally unlimited, but B/E has a reserve power to apply individual limits	Limited to a net debit cap on uncollateralised intra-day credit. The proposal retains a modified version of the net debit cap.
<i>Penalties on overnight extensions</i>	25 basis points over the RBA's cash rate	100 basis points over the Lombard rate	None – intra-day advances that remain outstanding are automatically turned into overnight advances	100 basis points over the key policy rate	Twice the MPC rate (Bank Rate)	Generally 400 basis points above the federal funds rate
- Inter-member borrowings	Yes, as agreed commercially; but the market is not thought to be sizeable	Yes, overnight or longer	Yes, overnight or longer	Yes	Yes, overnight or longer	Yes, overnight (no market for intra-day, same-day borrowings)
- Intra-day draw-down of fixed reserves	N/A	Yes	Yes	N/A	Yes	Yes

Table 2 (continued)

	Australia	Colombia	Eurozone	Norway	United Kingdom	United States
Collateral against central bank advances intra-day, overnight or longer¹⁰:						
- What is acceptable	Wide range of public sector and private sector securities, and A\$ domestic securities issued by selected supnationals and foreign governments and agencies	Public sector debt; no foreign securities (legislation in Congress is aimed at liberalising the definition of acceptable collateral)	Wide range of € public and private sector securities issued in EEA or G-10 countries	Wide range of public sector and selected private sector and foreign securities denominated in N Kr, €, US\$, A\$, £	Wide range of £ and € public sector securities; certain € cash deposits; exceptionally US\$ Treasury Bonds	Wide range of public and selected private sector and foreign securities in US\$
- Where held	Austraclear	DCV (the CSD for Government securities)	Any EU central bank, under the Correspondent Central Banking Model; Euroclear; Clearstream; any eligible CSD located in the € area	VPS, VPC, VP (the CSDs in Norway, Sweden and Denmark); Euroclear; Clearstream. For intra-day advances only, at the central banks in Denmark and Sweden (the Scandinavian Cash Pool).	Any EU central bank under the Correspondent Central Banking Model; Euroclear; Clearstream	Anywhere legally and operationally acceptable, including custodians and “borrower-in-custody” arrangements

There is a wide range of categories, and currencies, for collateral that is acceptable to secure advances by the central banks of these countries; and it appears that the collateral requirements, at least in respect of securities eligible for repo, are the same for intra-day as for overnight lending (except for the U.S., where intra-day loans are currently not collateralised, at

¹⁰ Collateral is in every case subject to haircuts, varying with the instrument and its maturity

least not for credit-worthy institutions). Public sector and specified private sector securities are eligible in all the countries except the U.K. and Colombia (although the restrictions in the latter country may be liberalised); and Norway and the U.K. also accept specified securities (and, in the U.K., cash deposits) denominated in selected foreign currencies.

The central banks of Australia and Colombia specify a local depository or agent that can hold collateral on their behalf; in contrast collateral to secure intra-day borrowing in Norway (but not overnight borrowing) can be held, on behalf of the Norges Bank, by the Danish and Swedish central banks, under the Scandinavian Cash Pool arrangements. A similar system is used by the ECB and the Bank of England, on whose behalf securities for use in intra-day and in overnight or longer repos can be held at any EU central bank, under the Correspondent Central Banking Model.

The ability of an RTGS participant to borrow overnight, or longer term, under routine central bank facilities in case of need is an important safeguard for the adequacy of intra-day liquidity in the system. These facilities may be supplemented by funds provided by the central bank as Emergency Lender of Last Resort. Table 3 shows that in each of the six reference countries, the central bank offers routine overnight credit by repo or collateralized loan. The

Table 3
Emergency Lender of Last Resort Facilities

	Australia	Colombia	Eurozone	Norway	United Kingdom	United States
Routine central bank credit facilities available for all RTGS system members:						
- Overnight	Overnight repo	End-of-day Lombard repo facility	Overnight loan or repo, under ECB standing facilities	Overdraft against collateral (D-loan)	Overnight repo, under Operational Standing Facilities	Overnight Discount Window loan against collateral
- Longer-term	Repos out to 12 months	7-day or 14-day loans (less frequent than overnight)	1 week and 3 month repos	Fixed-rate loans, varying maturities, against collateral (F-loan)	1 week and 3, 6, 9 and 12 month repos Also new Discount Window Facility, for banks to swap eligible collateral for UK Government securities, for 30 days	Term Discount Window loan against collateral, up to 90 days; also term auction facility (28-day and 84-day)
Emergency Lender of Last Resort facilities		Funds at 375 basis points over the Lombard rate; restricted to deposit institutions meeting certain criteria		Loans on special terms (S-loan)		

picture in respect of longer-term routine loans is varied, with Australia and the U.K. offering repos out to 12 months, while the Colombian central bank lends only out to 14 days. In addition the Bank of England has just introduced a permanent Discount Window Facility, under which banks can enter into a 30-day swap (extendable at the Bank's discretion) of eligible collateral for U.K. Government securities, which can then be sold in the market or repo'd to the Bank. In contrast to its existing repo arrangements, the collateral eligible to be swapped with the Bank

under the new facility includes a wide range of private sector debt, non-tradable debt and own-name instruments.

To supplement, if needed, their routine credit facilities the central banks in Colombia and Norway have standing emergency last resort facilities. (As mentioned in footnote 9 above, this row of the table excludes the temporary emergency facilities introduced by central banks in the last few months in response to the crises in their inter-bank markets.)

3.2 Interdependencies between payment and settlement systems

The issue of interdependencies between payment and settlement systems, flagged by the CPSS (2008), is shown in Table 4 to be important in all six reference countries, where the RTGS

Table 4

Interdependencies Between Payment and Settlement Systems

	Australia	Colombia	Eurozone	Norway	United Kingdom	United States
DVP, PVP or similar links to the RTGS system:						
- Financial market systems, including CCPs, CSDs and CLS	Selected systems only	Yes	Yes (For a transitional period links to some national systems will remain with NCBs; all other links are with the ECB)	Yes	Yes	DVP with Fedwire Securities Settlement System; PVP with CHIPS and CLS
- Settlement systems for other payment media	Retail payment streams	Available to all inter-bank net settlement schemes, including ATM, ACH and cheque clearing houses	Yes (For a transitional period links to some national systems will remain with NCBs; all other links are with the ECB)	NICS retail settlement system	Obligatory for bulk paper and automated net settlement schemes; optional for card and ATM networks	A variety of local and national clearing arrangements through the National Settlement Service

systems are linked, through DVP or PVP mechanisms, to a variety of financial market systems that settle transactions in securities, foreign exchange, and other financial instruments. The RTGS systems are also used in each country for the settlement in central bank money, typically through a variant of a PVP arrangement, of the net obligations arising in local and national retail payment streams, including card and ATM networks.

3.3 RTGS operating hours

Finally, Table 5 compares the operating hours of the RTGS systems in the six reference countries. The systems in five countries are open for transfers for 10 to 12 ½ hours each day,

Table 5

RTGS Operating Hours

	Australia	Colombia	Eurozone	Norway	United Kingdom	United States
Operating hours (local time):						
- Opening time	07.30	07.30	07.00	06.40	06.00	21.00 (ET) the previous calendar day
- Close for customer transfers	16.30	20.00	17.00	No standard cut-off times	16.00	18.00 (ET)
- Final close	18.30	20.00	18.15	16.30	16.30	18.30 (ET)

while Fedwire in the U.S. operates for 21 ½ hours each day, so that it opens during the operating hours of CLS, thereby aiding world-wide cross-currency FX settlements through the system. The system rules in every country except Colombia and Norway allow a final period, after the system has closed for customer transfers, in which the RTGS participants can exchange payments to manage their accounts, and achieve their target closing balances, at the relevant central bank. In Colombia customer transfers can be sent and received up until the final close of the system, while in Norway this final period is imposed by each bank on its own customers.

3.4 RTGS accounts and liquidity management

The findings of the World Bank survey, and the further information from the six reference countries, show clearly the framework in which RTGS system participants have to operate their accounts with the relevant settlement agents – the central banks – and in particular have to manage their intra-day liquidity. That liquidity is needed to cover the direct payments initiated by the participants themselves or requested by their customers; to settle, through DVP or PVP arrangements, transactions that the participants and their customers have entered into in a variety of financial markets; and to settle the net obligations relating to payments and receipts through retail payment media.

The primary source of that liquidity consists of overnight balances on the participants' central bank accounts, supplemented by the intra-day draw-down of any fixed reserves together with intra-day or if necessary longer-term credit from the central bank (these are together sometimes referred to as “grease” liquidity). The funds available to each participant from these sources are then recirculated round the system – one participant's out-payment becomes a receipt by another participant, who is then in a position to pass those funds on to a third (hence the emphasis, in some RTGS systems, on measures to ensure that their members make regular out-payments throughout the day, rather than attempting to hoard balances until late in the day). If the aggregate of grease liquidity and in-payments during the day is insufficient to enable any participant to release its out-payments promptly, a bank can try to obtain additional liquidity by borrowing from other institutions in the local money market for repayment next day or later, though if the market is short, or reluctant to take the risk on the borrower, this may be at a penal rate; alternatively the participant can turn to the central bank for further funding. How much inter-bank lending has in recent months been transacted in this late period is uncertain; banks most likely have had to find other means of achieving their target balances.

There appear to be no comprehensive current statistics showing the relative importance of the different sources of liquidity. Unpublished estimates from some years ago of which we are aware suggested that in an “efficient” RTGS system – i.e., a system in which the available liquidity was promptly recirculated among the participants, instead of being hoarded – the required quantum of grease liquidity amounted to some 10% to 15% of the daily system turnover; the prompt release of the residual 85% to 90% of daily turnover would then depend heavily on funds being speedily recirculated round the system. This is broadly consistent with

data presented by Hervo (2008) in a chart (Chart 4 on page 173) relating turnover in the French RTGS system during July to mid-September 2007 to the total of the participants' opening balances with, and intra-day borrowings from, the Banque de France. However, very different figures were reported by three of the six reference banks for the four months September to December 2007.¹¹ In Australia the daily average of intra-day repos with the Reserve Bank varied, as a proportion of inter-bank payments, between 5.9% and 7.2%¹²; in Colombia the total of intra-day repos and drawdown of fixed reserves with the central bank averaged 4.5% of transfers through the RTGS system; and in the U.S. average funds-related overdrafts at Federal Reserve Banks were equivalent to 1.7% of the average daily value of Fedwire transfers.

These wide differences, which merit further research, presumably reflect at least the specific banking system structures of each country and the settlement flows in their financial markets. There are also likely to be influences from the different monetary policy mechanisms and practices: thus in 2004/2005 in Colombia, with an easier monetary policy and lower reserve requirements than in 2007 and a high level of capital market operations, the average ratio of grease liquidity to RTGS transfers reached 8.5%, with a record peak of 14%.

A further, and increasingly important, factor in these and other countries, is the growing pressure on the Treasury functions of individual participants to manage more efficiently their requirements for intra-day credit, and specifically to minimize the cost of holding collateral-quality assets on their balance sheets to secure borrowings from the central bank or from other institutions in the money market. There is thus a complex three-way trade-off between the speed of recirculation of funds round the RTGS system, the availability of intra-day or longer funds from the central bank, and the availability of funds in the money market: all this against the often unpredictable level of potentially bulky settlement flows generated in the financial markets, including foreign exchange, securities, and other instruments.

It is clear that, whatever the specifics of each country, neither the demand for liquidity for any one RTGS participant nor its potential sources for that liquidity are static. The uses and sources of liquidity are affected by such factors as cyclical needs or seasonal variations;

¹¹ This period was selected to cover the start of the growing credit concerns in the inter-bank markets, leading up to the usual end-of-year tightening in the markets.

¹² In the same period unusually large overnight Exchange Settlement balances of banks with the Reserve Bank of Australia averaged AUD 3047mn, equivalent to a further 1.5% of RTGS turnover.

developments in many economies and markets, national and international; competition between participants; and the less tangible pressures of sentiment and market confidence. These factors underscore the importance of Recommendation 32 made by the IIF (2007) concerning the need for stress tests to measure the behavior of all material sources of cash inflows and outflows. Any RTGS participant that does not fully appreciate the potential for variations, in adverse circumstances, of the different components of its cash inflows and outflows generates risks for all the other participants in the system, as well as for its own customers and their counterparties; and that observation applies even more emphatically to any institution which operates both in its home country and in other countries through branches which participate in their local RTGS systems.

3.5 Issues for consideration

This analysis leads us to identify some specific issues. The first is supervisory – the importance for every central bank, as settlement agent for its RTGS system, of understanding the nature of the business, and the quality of the management, of every member of that system. This requires that each central bank maintain close contact with the regulators of every member, domestic and foreign, and with the home central banks of foreign banks that participates in its RTGS system. Quite apart from its concerns for the robustness and the stability of the system, and of other financial market systems to which that is connected by DVP or PVP links, before the central bank lends public funds to any member, intra-day, overnight or longer, it is entitled to satisfy itself as to the status of the borrower, where necessary by means of regular exchanges of information with the relevant authorities. For these exchanges to be effective, and timely, the central bank needs to ensure that the laws governing its own operations, and those governing the regulators of the RTGS members, domestic or foreign, permit the ready exchange of confidential information. (It may be noted that as settlement authority the central bank is in a good position to observe the way in which each member manages its daily liquidity, and so can, if permitted by law, pass useful information on that or other topics to the regulator. This is indeed a responsibility attributed to every central bank – Responsibility D – laid out by the CPSS (2001) in the core principles. Moreover, it can be important for the central bank, as settlement authority for the RTGS system, to be able to exchange information with the overseers or regulators of the financial markets and their infrastructures – which, critically, rely for the settlement of their

transactions on the smooth functioning of the RTGS system: hence the suggestion by the CPSS (2008) for closer cooperation and coordination among central banks and other authorities to address and manage the risks created by these interdependencies.

The exchange of information between the relevant authorities in different countries may be on a bilateral basis, or it may be conducted through a lead regulator or through a college of regulators or similar structure. Whichever route is taken, the availability of such information underpins the discussions, later in this paper, of the case for emergency lending by a central bank to the domestic branch of a foreign bank; and of the manner in which international banks can manage their liquidity on a global basis.

Secure and quantifiable sources of intra-day liquidity are important for every bank that is a member of an RTGS system. This objective is assisted where, in countries in which a bank has to maintain each day a fixed reserve with the central bank for monetary policy or other purposes, that bank is allowed to draw down its reserve balance during the day to provide liquidity for its RTGS out-payments, provided that the reserve is replenished in full by the end of the business day and that the intra-day drawdown rules are reinforced by severe penalties against any failure to make the end-of-day replenishment. The issue is, in essence, whether that facility would have any short-term detrimental effect on the implementation of monetary policy, and if so whether that effect would be more than offset by assisting the RTGS system in its objective of efficiently meeting in real time the payment needs of the financial markets and the real economy. (In countries where monetary reserves have to be maintained on an averaging basis, with the averages calculated on the balance at the end of each business day, the question does not arise, with the mechanism implicitly favouring the supply of intra-day liquidity to the RTGS system.)

In 65 of the 98 RTGS systems identified in the World Bank survey, and four of our reference countries (cf Table 2 above), the RTGS participants can draw down their reserve balances in full during the day; in a further 20 countries reserves can be drawn down only partially during the day. Thirteen countries did not answer this question in some cases because they do not require fixed reserves from their banks (Australia and Norway are in this category).

As discussed above, a key source of liquidity in any RTGS system is credit provided by the central bank. Important questions in any country with active markets in securities and other financial instruments are whether non-bank financial institutions, such as investment banks and securities houses, are eligible for RTGS accounts and, if so, whether they also have access to

central bank credit.¹³ Where an investment bank participates in an RTGS system which has DVP or PVP links to other market settlement systems, if it does not have access to central bank credit it may need to turn, at short notice, to commercial banks or other lenders in the money market for intra-day or overnight funding, so that it can in timely fashion meet its payment obligations and those of its customers, and avoid creating blockages through the systemic interdependencies. There is clearly an issue of competition between different institutional categories; but also relevant is any benefit to the country's financial sector as a whole if non-bank financial institution participants in RTGS systems have access to central bank credit when credit is not available from other sources but only intra-day and only for the purpose of settling transactions in securities and other instruments, under DVP or similar arrangements. (A similar issue arises where a central bank is the settlement authority for a market facility such as a clearing house or a CCP, which needs to make and receive payments through the RTGS system in respect of margin calls or repayments: if for any reason the facility is itself unable to finance or to release its out-payments, and it cannot raise funds from its members or in the open market, there may be a case for it obtaining temporary, and very short-term, credit from the central bank, so as to avoid any adverse impact on the market and its participants.)

This is clearly a minority view around the world. As discussed in section 2, in 64 of the 98 RTGS systems identified in the World Bank survey, participants other than commercial banks have direct access to the RTGS system, but in only 25 countries (including Colombia, the Eurozone, and Australia among our reference countries) do some or all of those non-bank respondents have access to central bank credit.

Whether a non-bank financial institution is a direct participant in an RTGS system, or only participates indirectly as a customer of a participating bank, it is likely to have to put up collateral against its intra-day liquidity needs. The supply of this collateral is eased if the securities or other assets that the non-bank financial institution is purchasing for its customers can be used for that purpose. This clearly requires the informed consent of the beneficial owner (or acquirer), under the governing law; but where the law permits this can be a valuable way to increase the flexibility of collateral arrangements.

¹³ This topic is discussed in section 2.3 above.

The extent of any central bank's willingness to act as emergency lender of last resort has traditionally been shrouded in ambiguity, so as to avoid the moral hazard of seeming too ready to support imprudent banking activities. It was not covered in the World Bank survey, and only two of our six reference countries (Colombia and Norway) confirmed that they did undertake such lending, the former only to deposit-taking institutions meeting certain (unspecified) criteria and the latter only on special terms (again unspecified). Over recent months, however, many central banks have shown that they are prepared to lend to banks and other borrowers on a very flexible basis, so that at least some of the ambiguity has been abandoned.

This issue is increasingly relevant because of the growing links within and between different countries' financial markets, and the consequential deepening of their interdependencies and vulnerabilities. The CPSS (2008) considers the implications of links between different systems within one country, and the extent to which the RTGS system forms a single point of potential failure for the entire financial system: in the event of any important failure, either financial or operational, there will inevitably be pressure on the central bank to lend to one or more of the RTGS participants, bank or non-bank, to avert the consequences. The potentially vulnerable links between countries' financial systems are created both by cross-border access to individual countries' market systems and by cross-border branching, with a bank incorporated in one country owning a branch in another country, where it is a full participant in the local RTGS system. If for any reason that branch cannot raise liquidity in the local market or (under routine facilities) from the host central bank, and is therefore unable to meet its local obligations, that fact will rapidly impact on the standing, and business, of its head office and other branches of the bank world-wide (and on the payment systems in which they participate) unless either the home-country or the host-country central bank steps in as last resort lender. There has been a traditional reluctance of central banks to act as emergency lenders of last resort to domestic branches of foreign banks, even where those branches have no sizeable base of deposits in the domestic currency, but recent events suggest that such lending can in the event be justified by extreme circumstances. It could, where the time-zones permit, be co-ordinated with the foreign bank's home central bank and banking regulator, and could even be supported by same-day swaps of the two currencies.

The issue of cross-border lending by central banks leads on to the wider question of the management of liquidity in international banks. It is often argued, by banks with active cross-

border branches, that they should be allowed to pool the liquid resources they maintain in respect of each separate RTGS system, so that they maintain in effect a global bucket of liquidity which is passed between their operations round the globe each day. The objective is clearly to reduce the total stock of relatively low-yielding collateral-quality assets that each such bank has to hold on its balance-sheet on the premise that the bank is unlikely to suffer a simultaneous liquidity problem in all (or many) of its world-wide branches, and that the liquidity needs of a few of its branches any day can easily be met by transferring funds from the global bucket.

Although the speedy raising and transferring of funds is now generally practicable, at least between the major currencies, the first part of that premise seems increasingly implausible. The heightened level of nervousness about every institution in most financial markets, allied to the speed with which news and information travels between markets, means that a visible liquidity problem at any one branch of an international bank is almost inevitably going to have a swift impact on all its other branches and accordingly on the ease with which they can raise liquidity in their local markets. This may be very difficult in practice, however, since the bank's branches may then call for funds from the global bucket, which would by definition be inadequate, thereby magnifying rather than diminishing problems for the bank as a whole.

The issue of central bank emergency lending also arises in respect of any RTGS system with tiered membership, where smaller deposit-taking institutions obtain access to the system as customers of its larger participants; and it arises where a participant is the local correspondent for a number of banks in other countries. If the RTGS participant is unable to settle because of operational problems, its business continuity plans should avert any impact on its customers, though those plans may involve some temporary cover from the central bank. In the event, however, of the insolvency of the RTGS participant the potentially widespread impact on its deposit-taking customers, domestic or foreign, and the second-order – and potentially even more widespread – impact on their customers in the real economy, would argue for the rapid substitution of a replacement RTGS participant. That may, however, not be quickly possible, not least because of legal concerns that all the customers of the failed bank must be treated equally. In such circumstances the central bank may need to step in on an interim basis, possibly to lend to those customers against collateral until a permanent replacement can be organised.

A final issue concerns the collateral requirements of central banks. Among the long-standing questions that have been raised on this topic is whether the range of collateral

acceptable for routine intra-day lending by a central bank should be harmonised with its collateral requirements for overnight lending. It appears from our research, at least among five of the six reference banks, that their intra-day and overnight collateral requirements have in fact already been harmonised (the exception is the U.S., where there is at present no requirement for collateral to be put up by credit-worthy institutions against intra-day credit, though that is expected to change by the end of this year). The extent of this harmonisation is logical, given that, as discussed by Summers (1997), an overnight loan is practically speaking more than likely an intra-day loan that has not been repaid by the close of business. Harmonization of intra-day and overnight collateral requirements is the *de facto* policy of countries which have recently injected overnight funds to support their inter-bank markets, and it could usefully be applied in countries where there is still any material difference in the collateral requirements.

Another long-standing question is whether, if at all, the requirements and the criteria applied by individual central banks should be harmonised. Our research shows that among the six reference banks there is only limited harmonization, and that mainly in respect of the stature of the debt issuer. The currency of the debt remains the point of greatest difference, which is probably inevitable given the contingent need for the creditor to seize and swiftly realise the collateral in its own currency. There is, however, some commonality in the currencies acceptable to the reference banks outside the currency home countries: thus selected € securities are taken in Norway and the U.K.; selected USD securities in Norway and the U.K.; and selected AUD and £ securities in Norway. Building on the base of this commonality of currencies, it appears that there may be some scope for harmonising the lists of acceptable issuers of public sector debt, but probably very little scope in respect of private sector debt issuers.

4 RTGS costs and pricing

The usability and production efficiency of RTGS systems is addressed in CPSS (2001) Principle VIII which states "The system should provide a means of making payments which is practical for its users and efficient for the economy." We have noticed that information about RTGS costs and pricing is not generally available across systems and that for those systems where it is, central banks have adopted a wide range of approaches to pricing RTGS services. Thus, RTGS systems tend to have less transparency and show less convergence in these areas than in other aspects of their design and operation. This diversity reflects a number of factors.

First, in other aspects of RTGS systems, such as legal foundations and risk control, the core principles provide relatively clear objectives and quite specific guidance on how the objectives might be achieved, and central banks have designed RTGS systems with this guidance in mind. In contrast, Principle VIII, that concerning efficiency (like Principle IX which deals with access), is not as specific. For instance, the notes to Principle VIII say that operators should "seek to economize on relevant resource costs by being practical in the specific circumstances of the system," and further note that "(a) system which is consistent with the demands of the markets it serves is likely to be more heavily used." The implementation guide expands on these notes by outlining the wide range of approaches taken by central banks to pricing their RTGS services, but it does not attempt to be definitive about best practice. This relative imprecision should not be a surprise, given the emphasis in RTGS systems on reducing risk rather than improving efficiency, but it may be one reason why international practice has not tended to converge as much as in other aspects of RTGS systems.

Second, a small number of central banks have a legal obligation to apply a particular pricing policy to services they provide, most commonly full cost recovery. In some other cases, the central bank's governing body has set full cost recovery as a policy to be applied to all services the central bank provides.

Third, central banks have a range of public policy views and supporting analyses that determine their approaches to recovering the costs they incur in providing RTGS services. Some apply a user pays approach and aim at full cost recovery, while others argue a case for subsidizing RTGS operations, given the benefits they can bring to the wider community in terms of contributing to financial stability.

Fourth, as a practical matter, the wide range of payments volumes processed in RTGS systems around the world means that in some cases, central banks' pricing options may be constrained because they cannot achieve scale economies. Thus, while it is axiomatic that every country should have an RTGS system for its national currency, low transaction volume is a practical reality that makes it difficult to apply common efficient pricing approaches.

Fifth, in a small number of cases the national RTGS is in competition with a near-substitute, privately operated large-value payment systems. Where the volume of large-value payments is sufficient to support more than one payment system, and a private system is in

operation, pricing may be set to allow competition between the private system and the RTGS system to take place on a level playing field.

4.1 RTGS costing and pricing in practice

The World Bank (2008) provides information on the RTGS pricing objectives of 94 RTGS systems. Our costing and pricing questions addressed to a sample of six reference countries, shown in the Appendix, provide additional insight into actual practices. The responses derived from these surveys are summarized in Table 6.

Table 6
RTGS Pricing Policies

No charges	8
Charges not based on costs	12
Partial recovery of operating costs	15
Full recovery of operating costs	13
Full recovery of operating costs + partial recovery of investment costs	7
Full recovery of operational and investment costs	33
Full recovery of operational and investment costs + profit margin	6
Total responses	94

The dominant theme in these responses is the aim of recovering all or part of the costs of operation of the RTGS system. At one extreme, a small number of central banks attempt to earn a rate of return in addition to recovering both their investment and operating costs, while at the other extreme, some central banks levy no charges, or levy charges unrelated to costs. In more detail:

- 33 central banks in the World Bank survey attempt to recover all their costs and a further six attempt in addition to earn a profit on their RTGS operations. Among our

six reference countries, in the U.S., and Norway the central banks aim to recover all their costs and earn a profit, while in the U.K. the Bank of England aims to recover its costs;

- 35 central banks including the Reserve Bank of Australia (representing one of our reference countries) reported an explicit policy of recovering less than their total costs. As discussed below, the ECB (whose TARGET 2 system was not included in the survey) and Colombia have established an analytical basis for this type of policy and appear to practice it to varying degrees;
- 20 central banks either have no charges or a policy which appears unlikely to result in the recovery of a substantial proportion of their costs.

Given the wide variety of conditions in which central banks operate their RTGS systems, there may be circumstances under which it is difficult to always meet these objectives. The World Bank survey did not ask that question, so at this point there is no systematic data on the extent to which central banks achieve their recovery objectives.

While the World Bank survey suggests a reasonable degree of homogeneity in policy approaches, i.e., varying degrees of cost recovery, in practice there is quite a wide variety in the ways central banks strive to implement this policy. This section illustrates some of those differences drawing on our six reference countries. Some of the key themes and facts are summarized in Table 7. The stated policies in the six reference countries aim at either full or

Table 7
RTGS Pricing in Practice

	Australia	Colombia	ECB	Norway	United Kingdom	United States
Cost recovery goal	Partial	Partial	Partial	Full plus profit	Full operating, partial investment	Full plus profit
Participants	56	160	1,072	23	15	6,819
Transactions per year (000)	6,400	2,330	92,000	137	33,030	133,605
Annual or monthly fees	None	≈\$3000 pa	None	\$28,000- 100,000 pa dependant on assets	Yes	Range of monthly fees depending on the connectivity selected
Transaction fees						
-paid by payer (P) and/or receiver (R)	P&R	P	P	P	P	P&R
-flat fees	\$A1.76	≈\$1.1		\$0.18	Yes	
-volume based			€0.08-1.75			\$0.16 – 0.52
-value based		2.50 COP per million COP for payments after 17.00 hrs				
-mode of delivery						\$30 for offline transfer
Private sector large-value payment system in competition	No	No	Yes - Euro1	No	No	Yes - CHIPS

partial recovery of the costs of providing RTGS services. They also show a wide variety in terms of both the number of RTGS participants and transaction volumes, and a range of approaches to achieving the desired degree of cost recovery.

The variety of pricing policies is captured by Bech, Presig and Soramaki (2008), who note that the combination of large fixed costs, often low transaction volumes, and a range of mandates for the provision of payments system services have led central banks to adopt a range of different strategies for recovering the costs of operating RTGS systems. Most systems they surveyed charge a fixed admission fee and the majority a per transaction fee. Some levy the transaction fee only on the payer, while others charge both the paying and receiving bank. Bech et al find that "A simple, flat transaction fee schedule is often used, but several systems base the fee on a combination of the volume submitted by the participant, the value of the particular payment, the submission time of the payment, and the mode of delivery, such as online or offline" (p15). The following discussion explores the inter-relationships between mandates, volumes, banking structure, and pricing policies in the six reference countries, which between them provide examples of all the features noted by Bech et al.

In the U.S., the Federal Reserve is one of the few central banks to be required by law to follow a particular pricing practice. It is required by the *Monetary Control Act 1980* to recover, over the long run, all direct and indirect costs of providing services, including imputed costs which would have been incurred had the services been provided by a private business firm. The Federal Reserve interprets this requirement to include RTGS services. To fulfill its obligations under the *Monetary Control Act*, the Board of Governors of the Federal Reserve System reports annually on its expenditures and income associated with the provision of these services. The Federal Reserve's *2007 Annual Report: Budget Review* (2008) reported operating expenses and imputed profit from operating the Fedwire funds transfer system and National Settlement Service of USD 63 million, which was less than 2 per cent of the central bank's total operating expenses. The Federal Reserve fully recovers these costs, principally through a "degressive" fee structure, in which the per transaction fee falls as volumes increase. The Federal Reserve also levies a series of monthly and annual fees for a variety of closely related services, but these account for a relatively small proportion of revenue compared to transaction fees.

In the U.K., the RTGS system, called CHAPS, is owned and managed by the CHAPS Clearing Company (CCC); it is operated by the Bank of England, to which various functions

have been out-sourced by the CCC, including monitoring the central queuing facility and the message flows. The Bank provides these services to the CCC on a full cost recovery basis. The Bank charges a small annual account keeping fee and levies transaction fees which account for most of its RTGS-related revenue; these fees are not publically disclosed. Fees are reviewed annually with the aim of breaking even over a four year horizon. The CCC recovers its costs directly from its members.

In Norway, Norges Bank makes it clear in its Annual Reports, and its Annual Reports on Payment Systems, that it aims for full cost recovery of RTGS services. In its *2007 Annual Report*, Norges Bank provides some detail on costs and revenues associated with the provision of RTGS services (see page 111). Costs are based on an exhaustive activity-based costing process. The recoverable costs include all processes associated with RTGS operations and the collateral management system including labor, rent, equipment, overheads etc. The overheads, which appear to be comprehensive, may not be included in estimates for all countries. Revenues accrue from annual membership fees and transaction fees. Because Norway has a relatively small number of RTGS transactions, the bulk of its RTGS- related revenue comes from membership fees, and the level of the transaction fee is lower than in many other countries.

In the Eurozone, the ECB has no statutory requirements pertaining to pricing. The ECB User Information Guide to TARGET 2 Pricing (October 2007) states that "With TARGET 2 the Eurosystem is aiming to provide a harmonized level of services at a single price structure for both intra- and inter-Member State payments and to achieve a high level of cost recovery." The ECB's phrasing is important, since it refers explicitly to a *high* degree of cost recovery, rather than *full* cost recovery. The ECB commissioned extensive theoretical research in preparing for the move from the original TARGET system to TARGET 2. This research provides a formal analytical basis for the ECB's pricing policies and is discussed later in this section. The ECB charges the paying bank a transaction fee, using a degressive pricing structure, with participants' per item charges falling at higher volumes.

In Australia, the Reserve Bank of Australia undertook a self assessment of its RTGS system in 2005, in which it reported its objective of recovering RTGS operational costs. In its *2007 Annual Report*, the Bank noted that the annual cost of providing these services was AUD11 million, which amounted to approximately 4-1/2 per cent of its non-interest costs. Recoverable costs include those associated with computer and communication systems, and staffing across

two permanently manned sites. The Bank recovers these costs through flat transaction fees levied on both the paying and receiving bank.

In Colombia, recoverable RTGS costs are defined to include a broad base of direct and overhead expense, and pricing results in the recovery of these costs. At the same time, and reflecting the type of analysis undertaken by the ECB (see below), the Banco de la Republica recognizes the principle of limited discounting of costs in light of the public good nature of RTGS services. With regard to price structure, the central bank sets a flat fee for RTGS transactions handled prior to 1700 hours and, to discourage banks from making payments late in the day, levies an ad valorem fee for transactions handled after that time. Total revenue therefore depends to some extent on the timing of banks' payment flows.

4.3 Issues for consideration

As is evident from the above discussion, the amount of detail published by central banks on the questions of RTGS operating costs and approaches to cost recovery varies considerably. The information that is available raises a number of questions that have a bearing on the practicality of Principle VIII and that are worth considering by central banks as they review their RTGS pricing policies. We have identified three principal questions.

1. What categories of cost are pertinent to RTGS operations and which of these costs are central banks seeking to recover?
2. Why do some central banks attempt to recover all their costs and in some cases also strive to earn a profit, while others seek to recover only a part of their costs?
3. What are the factors that systematically influence RTGS pricing?

Central banks are not always explicit about the categories of cost pertinent to RTGS operations, or their intent concerning the recovery of these categories of cost. Three broad classes of activities and their associated costs enter into the production of RTGS services:

1. Operating settlement or reserve accounts through which banks settle their obligations in central bank money is, of course, a core central banking function of long standing, dating from well before the introduction of RTGS. Yet, the "transfer of central bank balances" is the essence of RTGS. Most central banks have not traditionally charged for settlement accounts, and many do not do so today (although, as discussed below,

- they often charge for updating the accounts in real time through a message charge). The usual reasoning behind not charging is that providing settlement accounts is a core central banking activity, and therefore a public good. As such, it cannot be provided by commercial banks, competitive pricing principles do not apply, and as the natural monopoly providers' central banks should minimize barriers to using the service. At the same time, operating accounts is a generic banking service, and in fact several central banks treat reserve accounting as an overhead expense to be shared by their RTGS services (we believe this to be the case in Colombia, Norway, and the U.S., for example).
2. As discussed in section 3.1 above, the provision of intra-day credit is a common feature of RTGS systems. As an extension of overnight central bank lending practice, which again is a natural monopoly service and public good, sound arguments can be made for exempting this category of activity and cost from RTGS cost recovery. Doing so would tend to make central bank pricing practice across intra-day and overnight lending more consistent. Nonetheless, we do observe two typical types of credit-related charges in RTGS operations. Where funds are provided against collateral, a charge is often made for transferring asset ownership in a securities settlement system, which may be operated by either the central bank or a private operator. The repo rate and "haircut" applied to collateral assets are, insofar as we can tell, always determined by the market and are not seen as sources of RTGS operating revenue. The one central bank that does charge for intra-day credit is the Federal Reserve, but its motivation is to control the extent of its intra-day exposures, not to recover RTGS operating costs. Most other central banks make intra-day credit in RTGS system available free of charge so that banks are able to make payments easily, but protect themselves against credit risk by doing so only on a collateralized basis.
 3. Providing (real-time) funds transfer services in support of the transfer of reserve account balances is the third major category of RTGS activity and cost. Funds transfer services can be richly designed to meet the needs of account holders and the ultimate beneficiaries of the transfers and include features such as notification of credits to receivers, real-time monitoring of settlement account balances and the like.

Also, the transfer facilities are designed to protect central banks from the credit exposures they face in providing funds transfer services with final settlement. Providing funds transfer facilities at an acceptable level of reliability and security is costly, and in general the costs can be readily identified. When central banks speak of a policy of recovering some or all of the costs of operating an RTGS system, it appears that it is these costs they have mostly in mind. Most of the central banks that attempt to recover these costs do so principally through transaction fees. As noted above, transaction fees may be levied on just the paying bank or on both the paying and receiving bank. In most cases these are flat fees that do not vary by volumes originated or received, but in a few systems with relatively large transaction volumes, the fees are degressive.

The wide variety of practice suggests that it would be useful for central banks reviewing their pricing policies to be clear about which costs they are measuring and which costs they might seek to recover.

One level up from the categories of cost that enter into the calculation of RTGS recoverable costs is the strategy for recovering costs, either fully or in part. For those central banks whose strategy is to recover RTGS costs fully, efficiency is often a motivating goal. There is an extensive economic literature on efficient pricing of public goods and services that are provided in competition with the private sector. Very broadly, these principles call for public authorities to recover their costs (including profit that is akin to "normal profit" described in most microeconomics texts) and an allowance for taxes to which private sector firms would be subject.

The logic of efficiency underlies the requirements of the U.S. *Monetary Control Act*. Similarly, where the Reserve Bank of Australia provides services to the Australian Government in competition with the private sector (such as transaction banking and registry services), it does so on a commercial basis in line with Australian Government competitive neutrality guidelines, which require full cost recovery including a return on notional capital. In some cases, governments may expect central banks to provide all transaction services on a commercial basis, with the aim of maximizing profits; indeed, federal treasuries view central bank net earnings as a source of funds. Requirements such as these are consistent with the expectation that, like all public authorities, central banks should conduct their affairs in an efficient manner, and setting

prices with the aim of recovering costs is broadly consistent with what economic theory teaches. This is all the more so when the central bank's RTGS system is competing with a private sector large-value payment system.

Full cost recovery is generally agreed to be most relevant when public sector authorities, including central banks, provide services that are contestable, in the sense that they could also be provided by the private sector. Were such an approach not followed in those circumstances, economic theory suggests that it is likely the services will not be supplied efficiently from society's overall point of view. However, while some services provided by central banks are contestable -- such as providing transaction account services for government departments -- not all services provided by central banks are necessarily contestable.

With regard to RTGS services, only central banks can provide real-time settlement using a risk-free settlement asset, central bank money. Thus, it can be argued that rigidly applying principles that apply to contestable services to an RTGS system is not necessarily appropriate. On the other hand, where the private sector provides similar services in competition with a RTGS system, for example through a highly protected netting system which provides a high degree of confidence that ultimate settlement in central bank money will take place in a timely fashion, it could be argued that full cost recovery including a profit is appropriate if RTGS services are to be provided efficiently. Private sector systems have no ready means of systematically subsidizing operations. Thus, if they are to compete on the equal basis with the private sector, as would be necessary for efficient resource allocation, RTGS systems should follow the same approach.

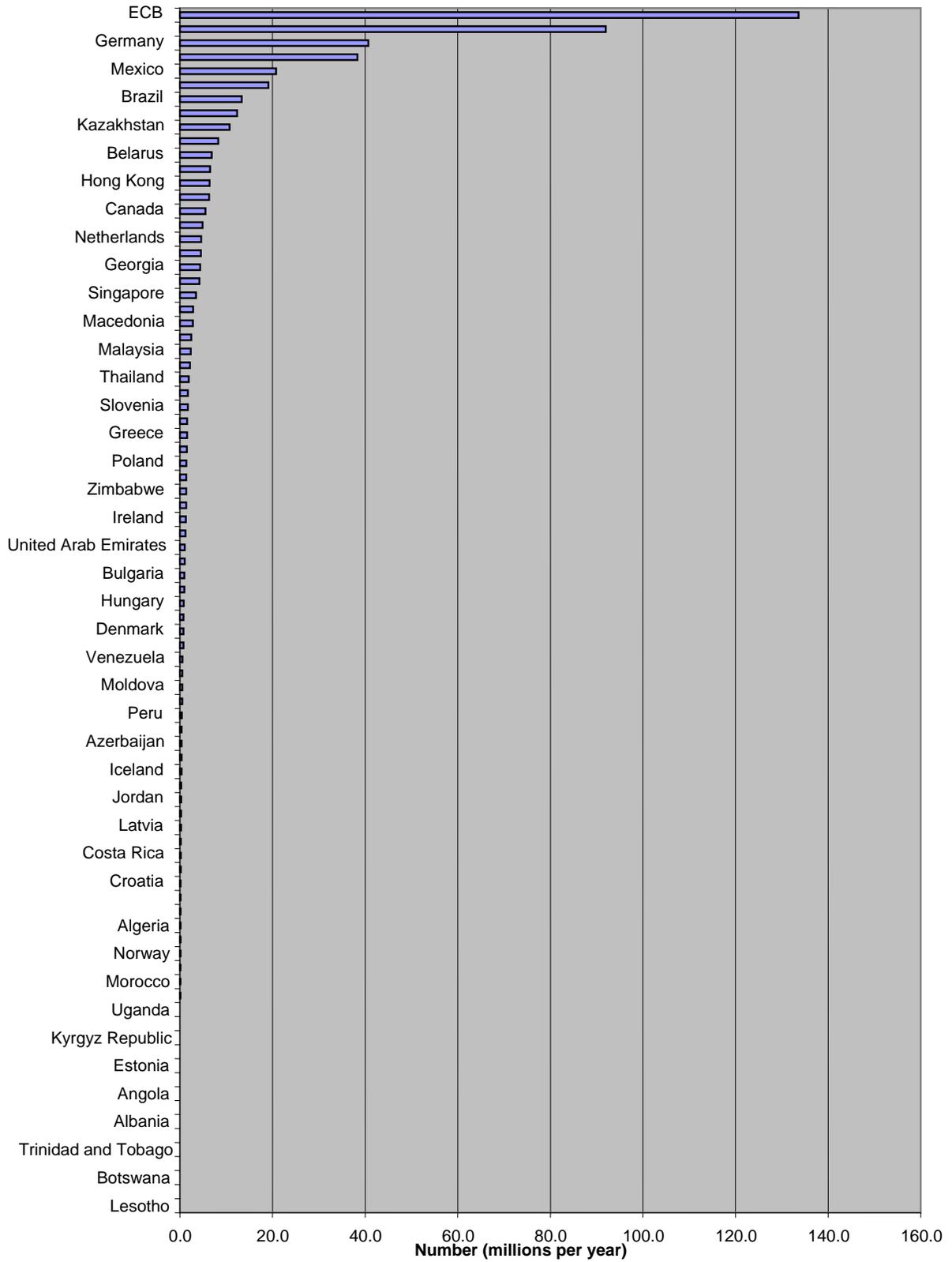
Nevertheless, many central banks have elected not to adopt a full cost recovery pricing strategy for their RTGS services. One reason is that in most cases the provision of RTGS services is simply not contestable – the volume of large-value payments is too small to support more than one system, so the question of efficiency of resource allocation between two competing systems is not the dominant factor driving policy. In many cases, a concern that setting prices to recover costs fully will discourage the use of RTGS is a more dominant determining factor.

In deciding on TARGET 2 pricing policies, the ECB commissioned a study of the optimal pricing rules for an RTGS system which faces competition from a private system. Holthausen and Rochet (2005) indicate that a subsidy is likely to be needed for the RTGS system if the

benefits of risk reduction are to be realized. One of the reasons this may be needed is addressed in another paper by the same authors (2006), in which they consider the optimality of different fee structures for RTGS systems. They find that pricing structures that provide discounts to large-volume users are desirable. In addition, however, they indicate that large fixed costs mean that it is often not possible to recover all costs, and at the same time continue to attract users to the system, where alternatives are available. Such alternatives could include a domestic ACH system or an RTGS system in another country where domestic banks also have operations. These studies provide some rigorous theoretical underpinning for the policies adopted by many central banks on more pragmatic grounds, namely, that the financial stability benefits of RTGS systems are such that some element of subsidy, sometimes implicit, sometimes explicit, is justified.

An important practical reality faced by most RTGS systems is a cost structure characterized by a combination of relatively high fixed costs and relatively low variable costs. Further, as shown in the World Bank survey, most RTGS systems process only a small number of transactions, suggesting that fully recovering costs through transaction fees would result in very high charges. Figure 1 shows transaction volumes for most of the RTGS systems reported in the World Bank survey. Seven countries for which transaction volumes have been reported are omitted from the graph – China, Czech Republic, Serbia, Slovak Republic, Switzerland, Turkey and Ukraine. In these seven countries, it appears that very large transaction volumes reflect the use of the RTGS system for transactions that would be settled in retail systems in most countries. Data for the Eurozone and for the Eurozone member states are included in the World Bank survey.

Figure 1
RTGS Transaction Volumes



The World Bank survey shows that apart from the Eurozone, the U.S., Japan and the U.K. which serve the world's main financial markets (and omitting the countries mentioned above), only about 10 countries process more than 5 million RTGS transactions per year. At the other extreme, more than 40 countries process fewer than a million RTGS transactions per year (around 4000 each business day). It is probably too early in the life of RTGS systems to say at what transaction volumes it becomes viable to recover all costs and not discourage usage. For many countries, however, an inability to achieve economies of scale is likely to severely constrain pricing options, and make full cost recovery impracticable in a business sense. Some central banks have judged that if they did attempt to target full cost recovery for the RTGS system, the level of prices necessary would so severely discourage usage that the objective of installing the RTGS system in the first place – to reduce interbank settlement risk – would not be met. If the cost-avoidance incentive were strong enough, banks might be encouraged to route large-value payments through systems with relatively weak risk controls, or to net obligations, perhaps even in an offshore arrangement that did not meet international standards (although, practically speaking, soundly practiced regulation and supervision of RTGS members, especially as this involves close coordination between central banks and the regulators of every RTGS member as argued in section 3.5 above, should be a sufficient guard against such behavior).

It is notable that at least the seven countries mentioned above, whose data are excluded from Figure 1, appear to handle a number of retail payments in their RTGS systems. In some cases this is the result of a conscious decision, while in others it probably reflects the fact that RTGS systems were introduced relatively early in the payments reform process and provided a convenient platform for the development of retail payments when there were no alternatives already available. While intentionally combining retail and large-value payments in a single system is rare in advanced economies (Switzerland is a notable exception), this is a way of spreading costs in economies with relatively few large-value transactions.

This discussion suggests that the wide variety of national circumstances leads central banks to pursue a range of RTGS service costing and pricing policies. The World Bank survey highlights that there is a large number of emerging economies whose pricing options are severely limited by the scale of their RTGS operations. These economies will need to give particular consideration to the design and cost of systems they install if they are to establish policies that, over the longer term, seek a substantial degree of cost recovery.

While not straightforward, it is possible to draw out some consistent patterns and to identify some systematic factors explaining RTGS pricing practices. Most central banks appear to rely relatively heavily on revenue from transactions rather than membership fees, although fixed monthly or annual fees ("participation fees") are not uncommon especially in cases where RTGS transaction volume is low (an example among the six reference countries is Norway). As a practical matter, it may make little difference in terms of each RTGS system's cost recovery whether annual or transaction fees are charged, so long as the fees are determined on a basis that can be explained and justified to the RTGS system participants.

Differences in fee structures may, however, be quite important for incentives. Annual fees are less likely than are transactions fees to influence at the margin whether payments are made through the RTGS system or through a competing system. One factor that may help to explain the common reliance on transaction fees is the degree of tiering in RTGS systems. Usually, only direct participants provide a revenue source through membership fees. The TARGET 2 system has around 1,000 direct participants, and a further 9,000 indirect participants that access the system as customers of the direct participants. Similarly, in the U.K., CHAPS has 15 settlement members who in turn provide RTGS payment services to around 400 banks. Similarly, banks providing correspondent services are usually direct members of RTGS systems in local currencies and provide payment services to their foreign bank customers.

Many systems (e.g., Australia, Norway, and the U.K.) have flat transaction fees, while in both the Eurozone and the U.S. degressive fees apply. This pattern is consistent with the findings of Holthausen and Rochet (2006), whose work points to the benefit of fees that decline as volume increases. Such a fee structure would encourage the use of RTGS systems by banks that have relatively large transaction volumes, as is true in both the U.S. and Eurozone, where large banks have large numbers of large-value transactions, and the RTGS systems compete directly with private sector large-value systems. This pricing option is much less likely to be available to central banks in countries where the total volume of large-value payments is much smaller than in the U.S. or Eurozone (most countries according to Figure 1).

Other pricing strategies used in some countries are designed to encourage particular behavior by participants rather than to recover costs. For instance, pricing in the Colombian and Swiss systems provides incentives to participants to make payments early in the day, to encourage more efficient use of liquidity. The Swiss system charges flat fees which are higher

for transactions that are entered into the system or settled later in the day, as well as being higher again for payments above CHF100,000 which are settled after 1100 hrs. In Colombia the central bank charges a flat fee for payments made before 1700 hrs and after that time an ad valorem fee of 2.5 COP per million is charged. In the U.S., banks are encouraged to use more automated means of submission by higher charges for a transfer initiated offline.

Appendix

RTGS Research Questions

For a paper by

Peter Allsopp, Bruce Summers and John Veale

This survey is in support of a research paper which is described in the abstract shown as Attachment I. In many respects RTGS systems have become more homogeneous, as operators have ensured that their systems comply with the *Core Principles for Systemically Important Payment Systems*. However, there remains considerable variation in a number of practical aspects. The purpose of this paper is to develop a better understanding of the extent of this variety. We are seeking "on the record" comments from central banks and do not expect confidential responses or proprietary information. As arranged on the telephone, one of us will contact you in the near future to discuss your answers to the questions. Thank you in advance for your support of this effort.

Settlement Services and Access

1. What underlying payment transactions are viewed by the central bank (CB) as systemically important, and therefore call for settlement in central bank money and in real time?
 - a. Wholesale or large-value – which individual categories?
 - b. Retail or low-value – which (if any) individual categories?
2. What categories of account-holding institution are responsible for each of the transaction categories listed in the answers to 1 (a) and (b) above? e.g., commercial banks, investment banks, securities houses, CSDs, CCPs, non-bank payment providers/processors, others?
3. What categories of financial institution are eligible to hold accounts at the CB, using the categories in the answers to 2 above?

4. For each account-holding institution, is membership of the RTGS system and use of its account for final settlement –
 - a. Automatic?
 - b. Obligatory?
 - c. Optional?

5. What sources of liquidity (apart from overnight balances with the CB, receipts from other members during the day, and outright sale of financial assets for same-day value) are available to all the RTGS members, or only to certain specified categories of member, to finance their out-payments during the day?
 - a. Intra-day advances from the CB by means of loans, overdrafts or repos?
 - b. Same-day value borrowings from other RTGS members?
 - c. Intra-day drawdown of any required or statutory reserves (e.g. held with the CB for the purpose of monetary policy, or to finance the CB itself), in full or in part?

6. Is an overall limit set by the CB on the intra-day advances (5 (a) above) that it will make to an individual member, and if so how is that limit calculated?

7. What penalties are prescribed, if intra-day advances from the CB remain outstanding overnight?

8. What categories of collateral are acceptable to the CB against intra-day advances, and what haircut is imposed, e.g., bonds, including domestic public sector, domestic private sector, foreign public sector, foreign private sector, or other categories (please specify) of non-debt asset, including balances with foreign central banks?

9. Where does acceptable collateral have to be lodged or held, to ensure legal title for the CB, as owner (under a repo) or pledgee?

10. What DVP, PVP or similar links are in place between the RTGS system and all other elements of the financial sector infrastructure that generate systemically-important

payments (e.g. CCPs, CSDs, ACHs and clearing houses for other payment media; cf 1 above)?

11. What are the operating hours of the system (in local time), and is there a cut-off time for customer transfers ahead of the end-of-day closure for member-to-member transfers?
12. What is the daily ratio (averaged over September to December 2007) of turnover in the RTGS system to the aggregate intra-day liquidity taken from the CB (i.e. 5(a) and 5(c) above) by all members of the system?
13. What, if any, routine facilities exist for overnight or longer lending by the CB to any, and if so to which, categories of RTGS members? What terms and conditions are attached to any such facilities?
14. What, if any, Emergency Lender of Last Resort facilities have been announced by the CB, or publicly acknowledged as available, and to which categories of RTGS members? What terms and conditions are attached to any such facilities?

Costs and Pricing

15. The 2007 World Bank global payment systems survey (summarized in Attachment II) shows that central banks aim for a variety of levels of cost recovery and profit in their RTGS pricing policies. Does your central bank have any statutory obligations or published statements setting out its policies on this question?
16. A central bank typically undertakes three related activities in providing RTGS services to banks and other financial institutions:
 - Operating settlement accounts
 - Providing intra-day credit to participants in the system
 - Providing funds transfer facilities

Does your central bank maintain separate profit and loss accounts related to any of these activities? Are they published?

17. What costs does the central bank incur directly in providing funds transfer facilities, e.g., operating computer systems, communication services, staffing, etc.? Are similar costs incurred by payments associations or other operators providing some or all of these services? If so, how do they recover their costs from participants?
18. What percentage of the central bank's overall costs are its costs of operating the RTGS system?
19. To what extent are costs associated with each of the three activities described in question 16 subject to your cost recovery policy? Are any of these activities explicitly subsidized?
20. If your central bank pays interest on overnight balances in banks' settlement accounts at less than the market rate of interest, is the resulting interest margin treated as income in accounting for the cost of operating these accounts?
21. Does your central bank impose explicit charges for providing intra-day credit to participants in the system (in addition to any charges they may incur for transfer of collateral in a securities settlement system, or any haircut imposed on the collateral for risk management purposes)? Is the central bank's income from this lending or repos treated as income in accounting for the cost of operating these accounts (see question 16).
22. The 2007 World Bank global payment systems survey shows a wide range of volumes of RTGS payments in the surveyed systems. To what extent does the volume of RTGS transactions constrain your ability to recover costs to the desired extent? Have you responded by imposing charges not based on transaction volumes? If so, what are the charges?

23. If your country has a private sector high-value payment system operating in competition with the RTGS system, to what extent do your RTGS pricing policies take this into account?
24. Does the central bank consult RTGS system participants on its pricing policies as a matter of course?

Evaluations

25. Has the national RTGS system ever been subjected to external assessment under the IMF/World Bank FSAP process, or has it been the subject of an internal self-assessment process? Is any material resulting from such an assessment publicly available?

Attachment I

Abstract

The Future of Real-Time Gross Settlement:

The Role of the Central Bank

From a 2007 World Bank survey we know that 106 countries have real-time gross settlement (RTGS) systems, that in every case the systems settle on the accounts of the national central banks, and that in 103 instances the central bank is the operator of the system. The survey results as well as other evidence indicate that central bank operational principles and practices vary greatly across these systems, though a common understanding of many key topics has been assisted by the issuance in early 2001 by the Bank for International Settlements of the Core Principles for the design and operation of systemically important payment systems. The variations in RTGS policy and practice broadly fall into three categories: eligibility to use RTGS services; terms under which credit and liquidity are provided; and costing and pricing of services. A decade of experience with RTGS across financial systems in different stages of development, in an increasingly globalized payment marketplace, has revealed a number of practical problems for both central bank operators and the users and other beneficiaries of RTGS services.

This paper identifies, explains, and assesses the practical problems that face RTGSs in the areas of access, credit and liquidity, and costing and pricing. The purpose is to motivate operationally concrete responses by individual central banks to system-specific problems, and by consortia of central banks to multi-system problems that call for harmonized approaches. The assessment is informed by published information on RTGS principles and practices, supplemented by real world examples involving a small group of RTGSs representing both large and smaller financial economies, and economies in different stages of development (to include systems operated by the ECB, Federal Reserve, Bank of England, Reserve Bank of Australia, Norges Bank, and a yet to be identified central bank representing a developing financial economy).

Official central bank RTGS access policy (BIS, *Core principles for Systemically Important Payment Systems*, January 2001), as well as guidance for the development and operation of RTGSs (BIS, *The role of central bank money in payment systems*, August 2003; BIS, *General guidance for national payment system development*, January 2006) shows up the frequent conflict between the questions of best practice to achieve safety and efficiency objectives, on the one hand, and scope of access on the other. The 2001 core principle pertaining to access is the least operational of all the core principles, requiring only that each central bank establish objective and public criteria for access that is “fair and open.” This is in contrast to the concrete guidance provided elsewhere in the core principles that settlement should take place using deposit money held in central bank accounts. While the desired settlement solution requires use of central bank accounts, access to accounts is limited by guidance which is rooted in the traditional correspondent banking model, which tends to result in tiered access to RTGS services for other financial institutions through commercial banks as the “gatekeepers.” Accordingly, in practice, access to accounts by different classes of institutions whose business models give rise to large payment and settlement flows varies widely across national central banks. Although these variations reflect differing national characteristics, often based in historical realities, the result is that global institutions that participate in numerous payment systems can be RTGS eligible in some jurisdictions but not in others; similarly non-bank financial institutions whose business generates large payment and settlement flows are not eligible for access to RTGSs on a consistent basis.

Our assessment distinguishes carefully between three operational modes of access (to accounts and credit, to accounts only, and indirectly to central bank settlement through account holders). We examine instances where access that is determined by class of institution rather than by business risk profiles regardless of institutional class results in undesirable risk containment and efficiency outcomes in both national and international settings. We offer practical advice to help sharpen operationally the RTGS access principles promulgated by the international central banking community, and to assist central banks in developing economies to craft their national access rules. The treatment of access sets the stage for consideration of RTGS credit and liquidity practices.

Our premise in considering RTGS credit and liquidity provisioning practices is that central bank intra-day and overnight lending policy and practice should be harmonized and rationalized, in that, practically speaking, an overnight loan is more than likely an intra-day loan that “has not been repaid by the close of business” (Summers, “Inter-bank payment arrangements and lender-of-last-resort,” *Central Banking*, Spring 1997). In light of the essential role that central bank short-term credit provisioning plays in the overall liquidity schemes under which financial markets settle their transactions, and the key role accorded to central bank accounts, our assessment focuses on how well aligned policy and practices in these areas are with the needs of RTGS participants on the one hand, and central bank risk managers on the other. The RTGS is explained as a single point of failure across the entire financial system, in that participants face liquidity impacts from all their DvP and Pvp links, as well as settlement links to clearing houses and other elements of the financial markets’ infrastructures. Moreover, such links in a number of cases are to systems, including RTGSs, in multiple countries and currencies simultaneously with the need for rigorous calculation of the liquidity required across systems, and the need to deploy liquid collateral denominated in one currency across several RTGSs. At issue is the willingness and ability of RTGS members to recycle their surplus liquidity within and across RTGSs, as well as the willingness of central banks to establish compatible collateral practices and operations that support the members’ use of collateral across systems, including private sector debt.

The close links between RTGS access and credit/liquidity practices are explored with emphasis on the role of the central bank as lender and RTGS service provider of last resort to institutions that compete in the same lines of business and share risk profiles. The questions naturally lead to consideration of central bank lending through their RTGSs to institution types

including investment banks, securities firms, central counter-parties, CSDs and clearing houses. At issue as well is whether, in an RTGS system with tiered membership, the central bank should be prepared to act as emergency lender-of-last-resort to the customers of an illiquid settlement member. We also examine the central bank operator best practice of monitoring each member's intra-day liquidity management, and the establishment of close operational links with the supervisors or regulators of RTGS members that permit timely utilization of information needed to judge member risk and potential systemic risk.

The RTGS costing and pricing practices of central banks are not only disparate, in many instances their foundations in cost accounting and applied price theory are often obscure. We lay out the full RTGS cost function including 1) administering settlement (reserve) accounts, 2) provisioning credit and managing risk, and 3) providing funds transfer services. Using this model, we distinguish between RTGS operations that are governmental in nature and those that are more characteristic of private financial services, all in order to be clear about which services are relevant to what type of pricing strategy. The implications of "users should pay" pricing when efficiency is the objective (Holthausen and Rochet, "Efficient pricing of Large Value Interbank Payment Systems," *Journal of Money, Credit, and Banking*, 2006) is examined against the reality that most national RTGS systems operate at volumes that are below efficient scale for capital-intensive businesses. Further, pricing is examined in the broader context of efficiency when the aim in introducing RTGS is to promote financial stability, and the uniqueness of "ultimate settlement" through RTGS. Our assessment of costing and pricing draws out the implications for public policy in developing economies that have yet to establish RTGSs, and in developed economies whose central banks are struggling to meet cost recovery mandates for the services they provide. The issue of efficient scale is also examined in the context of smaller economies to answer the question whether a smaller economy can afford to support both RTGS and competing deferred net settlement (DNS) systems.

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June 11, 2008

Attachment II

World Bank Global Payments Survey
RTGS Pricing Policies

No charges	8
Charges not based on costs	12
Partial recovery of operating costs	15
Full recovery of operating costs	13
Full recovery of operating costs + partial recovery of investment costs	7
Full recovery of operational and investment costs	33
Full recovery of operational and investment costs + profit margin	6
Total responses to questions on RTGS pricing	94

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