

"Financial Market Infrastructure:
Safe and Efficient Payment, Settlement,
and Clearing Systems"

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Good afternoon ladies and gentlemen. It is indeed a pleasure for me to be here this afternoon and to participate in this conference. After all, it's not very often that one has a chance to visit "Shangri-La". In James Hilton's novel "Lost Horizon", Shangri-La is a legendary place where life approaches perfection. And while the legendary land of Shangri-La remains beyond our reach, I believe the theme of perfection -- more specifically the pursuit of perfection -- is certainly appropriate to my topic today.

I have spent a significant amount of time over the last two decades managing payments system operations. I can tell you from experience that users of these systems quickly come to expect perfection in terms of reliability, security, and integrity of operations. Moreover, the more pervasive the payments system, the more dependent its home markets are on that system for the necessary liquidity to keep them going. In times of stress, perfection is the *minimum* requirement.

My remarks today will both illustrate the need for and define payment system attributes that may guide us in our pursuit of perfection. They will also describe what I consider to be the essential defining trade-off that has governed the evolution of modern payments systems since the 1970's--the trade-off between

ever-increasing levels of technology and growing levels of inherent risk. Finally, based on the lessons learned in payment system evolution, I want to suggest five factors that I believe must be present in any effective payment system.

My opening premise is simple and straightforward: Effective and efficient money and capital markets *require* a broad and sturdy infrastructure of payment, settlement, and clearing systems. This infrastructure -- which comprises a nation's payments system -- is the mechanism permitting market participants to express economic choices and to exercise those choices by the transfer of value. Just as an effective transportation and distribution system is essential for the efficient movement of goods to market, so, too, is an effective payments system essential for the efficient transfer of value. If money and capital markets are to gather and allocate their resources efficiently they *must* have access to an effective payments system. And to follow this reasoning one step further, as market activities become increasingly international in scope, an effective *international* payments system is required -- with all of the additional complexities implied by different currencies, different operating hours and different regulatory environments.

BACKGROUND

There is ample evidence to support the linkage between payments systems and financial markets in developed countries. Perhaps the best indicator of the growing importance of payments

systems to domestic economic growth is the steady rise in funds transfer activity. In the U.S., for example, the daily average value of Fedwire funds and securities transfers in 1983 was \$475 billion. By 1992, the daily average had increased nearly threefold to \$1.35 trillion. To put these trends in perspective, Fedwire activity turned over the equivalent of the U.S. GDP every 7 days in 1983. By 1992, U.S. GDP turned over every 4-1/2 days through Fedwire.

Rapid growth in domestic transfer activity is mirrored by growth in international transfer volume. In 1977, the survey conducted by the Federal Reserve Bank of New York and the Foreign Exchange Committee showed FX contract volume in the U.S. running at \$5 billion a day. The survey in 1992 showed U.S. volume of \$241 billion a day, and global volume of just under \$1 trillion per day. Given these amounts, it is hard to underestimate the need for perfection. Put another way--the payment system has been likened to the "plumbing" of our banking structure. It is possible to survive without water for a day or so. However, it is hard to imagine the world's sophisticated financial markets operating even that long without payment systems that operate nearly perfectly.

Perfection is usually difficult to achieve, and that certainly is the case in the payments system arena. However, it is not too difficult to list the attributes that payments systems must incorporate in pursuit of perfection; **accuracy**, -- **security**, -- **reliability**, -- **timeliness**, -- and **certainty** are the principal

attributes sought in these systems. The presence of these factors, in turn, is determined primarily by the system's design. And, finally, the system's optimal design is determined by addressing in an integrated manner a series of technological, structural, and legal or regulatory issues. Let me say just a few words about each of these areas.

As it turns out, the technological issues are the easiest to solve. With each passing year, technological advances offer more choices with greater capacity at lower unit costs. I don't mean to imply that it's easy to make the right technological choice; I simply mean that increasing technological flexibility makes it more likely that a good solution can be found for just about any technological problem. Besides, in the payments system arena, there are models available that can provide insight into what choices are effective under various circumstances.

Structural issues can be far more difficult to resolve. These structural issues involve the definition of payments system participants and their roles, particularly the role of the central bank. All central banks perform a common identical function in payment systems--that of providing the ultimate source of liquidity, or what is known as the finality of the payment. When a central bank debits or credits accounts for a payment, that payment is final and backed by the full resources of the central bank. Beyond that, payment systems also can have certain "public good" aspects, such as the need for broad-based access, that are important concerns for central bankers.

To address these concerns, Central Banks often play an operational role in the payment system but the nature of this role can vary widely--some have a very active operational presence, some do not. Some Central Banks provide the payment system infrastructure themselves, some are major participants on behalf of account holders, and some leave these more active roles to the commercial banking system and participate solely in payment system regulation. For a particular Central Bank, the appropriate operational role will depend on factors such as the size and geography of the country and the state of its commercial banking system. For example, Russia, spanning 11 time zones, faces payment system operating issues that are not a concern of smaller countries.

The existence of alternatives will also influence the central bank's role in the payments system. Countries with a well-established commercial banking system may not be likely to require as much Central Bank involvement in interbank clearing all other things being equal. These commercial banks may be able and willing to make the investments and provide the operational resources required to perform interbank clearing. Typically, a combination of Central Bank and private sector participation in the payments system is thought to provide an optimal level of control over the crucial interbank payments process, while providing flexibility for private initiatives to compete in this area. The increasing internationalization of the payments system has, if anything, complicated structural issues, since

increasingly very different systems need to work together to ensure the smooth fabric of each day's settlement.

Legal and regulatory issues also must be addressed to establish the rights, obligations, and liabilities of all parties in the payments system. At a minimum, participants need to know: when is a payment final, that is, complete and irrevocable, particularly when it has not been settled through a central bank; who is liable when a payment transaction is not completed correctly; how quickly must payments be acted on by intermediaries; and, what are the consumers' rights in the payment system?

Often taken for granted, this legal framework is absolutely essential; it comprises the foundation on which a payments system can be implemented and operated. A payments system without a broad and substantive legal framework, like a building without a foundation, will not be able to withstand the rigors of use under stressful conditions. Once again, the increasing level of international payments requires an increasingly robust international legal framework to support this activity. It is also important to note that this framework cannot be developed in a vacuum. The rulemaking process must be sensitive to the technical mechanisms used to make payments. As a result, the rules may differ somewhat depending on the particular technical mechanism that is used for different types of payment arrangements.

PAYMENTS SYSTEM EVOLUTION

It should be obvious at this point that there is not one, single, correct payments system implementation. There are, instead, a series of related tradeoffs that must be considered -- not the least of which is the trade-off between technological efficiency and safety. Creative applications of technology permit us to move huge amounts of money around the world at the speed of light. Hundreds of thousands -- even millions of transactions can be processed by computers in a small fraction of the time it would otherwise take. It is safe to say that many of the international markets that exist today could not function without this technology. But how do we capture the efficiencies offered by technology without losing control of the payments process or creating new and unacceptable risks to payments system participants? Let me offer a brief historical overview to put this question in perspective.

In the 70's and early 80's, technology was applied to payment and clearing systems with a vengeance. Automated payments processing and communications systems, such as Fedwire and CHIPS in the U.S. experienced phenomenal growth in the numbers of on-line participants and in the volume and value of transactions processed. Bigger computers were linked using faster networks to carry increasing numbers of payments to more and more participants at ever increasing speed. Throughout this period it seemed that "bigger" and "faster" meant "better". And, in many ways, this was true. However, technology can be a

double-edged sword. Our ability to deliver payment and securities transactions can outpace our ability to settle these transactions. Payment transaction delivery was essentially real-time for on-line institutions, but settlement -- the actual posting of entries to participants' settlement accounts -- was typically an end-of-day (or next day) processing activity. Even in systems that settle with each transaction--so called real time gross settlement systems like Fedwire--payment transfers were completed without regard for balances on hand. As a result the amount of intra-day credit -- or what is called daylight overdrafts -- incurred by payments system participants grew at a staggering rate.

Similar application of technology to the securities and foreign exchange markets increased both the volume and the velocity of turnover in these markets. The time lag between the initiation and ultimate settlement of securities and foreign exchange transactions was even greater than the time lags in settlement of pure payment transactions. As a result, the temporal risk incurred by market participants was greater as well.

As the 70's gave way to the 80's, countries around the world began to take note of the growing risk inherent in their payments systems. Isolated payment system problems during the 70's and the losses that resulted served to focus the attention of commercial banks and central banks on the problems of risk. Most notably, the failure of Bankhaus Herstatt, a German institution

active in foreign exchange markets, caused more than a ripple in the markets when it was closed *after* receiving payment for certain foreign exchange transactions but *before* completing contracted counterpayments. As a result of this and other isolated incidents, payment system priorities by the mid-80's were refocused on risk.

Participants in clearing systems are exposed to several types of financial risk. The first is credit risk -- can your counterparty pay? The second is liquidity risk -- will your customer fund his payments timely so that the bank can make settlement? In the banking business -- as in just about any business -- you control credit and liquidity risks by knowing your customer and your counterparties. In payment systems, however, there is a third risk-- systemic risk. This is the risk that the inability of one participant to meet payment obligations will cause other unrelated participants to fail to settle, thereby restricting, if not eliminating, liquidity within all the markets served by the payments system. Of the various kinds of risk, it is usually systemic risk in some form that is of most concern in assessing the risks associated with payment systems.

These risks are not new. They were not created by technology changes in the 70's. However, this technology change did increase the levels of risk and made risk control more difficult. By the mid-80's, technology was applied to *improve* risk control in domestic payments systems. Sophisticated

software systems were developed to measure risk as a first step toward controlling it. With some prompting from regulatory authorities, risk management software began to be integrated with and operated as part of the payment system applications.

In response to the growth in transaction volume, payment flows and associated risks, payment system and financial market participants have turned increasingly to netting systems to achieve efficiencies. There are many varieties of netting arrangements, but they are all based on the same principle -- the gross obligations between counterparties are offset, one against the other, and only the difference, the net, is actually settled. Netting arrangements have the potential to reduce significantly both the number of settlement transactions required and the amounts to be settled; they also can significantly increase risks without both a firm legal standing for the net settlement arrangement and controls over the sources of systemic risk which can be heightened in the netting process.

Special measures to control risks in net settlement systems were developed during the 80's. These measures include shortening -- as much as possible -- the amount of time between the delivery of a transaction and its associated settlement, as well as the adoption of laws, rules, or regulations to enforce settlement finality, procedures to monitor intra-day credit, and real-time mechanisms to enforce counterparty credit limits. Participant loss-sharing agreements are also effective, particularly those backed by a collateral pool or other sources

of liquidity to assure settlement in the instance of the failure of individual participants.

The last half of the '80's and the '90's brought with them still another focus for payment system developments -- a focus on international markets and the payment system operations necessary to support these emerging activities. Four years ago rigorous minimum standards were established by the BIS-- including the measures discussed earlier -- to govern the formation and operation of multilateral clearing arrangements that involve participants from many countries. These standards are designed to enhance the likelihood that international payment systems will be sources of strength and not sources of weakness in times of market stress. In essence, today we are faced with the challenges of achieving technology-based efficiencies on a global scale while expanding our risk control programs to address the international operating environment.

PAYMENTS SYSTEM FACTORS

When we combine our need for perfection in payments systems with the lessons learned over the last 20 years or so of payment system evolution, what can we say about the generic characteristics of an effective payment system? What are the factors that must be present in modern payment systems if we are to rely on them to the degree necessitated by the volumes and values transferred in accommodating growing financial markets? Let me suggest five: finality; control of intraday credit; effective oversight; effective back office processes and

contingency planning; and international cooperation. While I have referred in some way to each of these earlier, let me briefly discuss each and its implications.

Finality. Irrevocable funds availability at a predictable time minimizes uncertainty and counterparty risks. In theory, finality can be provided by any financial intermediary; in reality central banks are the only providers of finality that do not present counterparty risk of one sort or the other. In payment transfer systems, finality can be guaranteed by settlement across the books of a central bank or ensured by collateral or other sources of liquidity in net settlement systems. In security transfer systems, finality for all practical purposes occurs through a combination of delivery of the security itself and a final payment in a process known as delivery versus payment or DVP. In foreign exchange settlement, the practical concept of finality occurs when both currency legs have been completed by final payment transfers.

Finality can occur transfer by transfer--as in real-time gross settlement systems--or periodically as in net settlement systems. However, as financial markets mature, and payment volumes and values grow, the desirability of real time gross settlement across the books of a central bank particularly for high value transfers has been recognized by most developed economies. Finality will, of course, depend on the underlying legal system that governs payments, or by the particular rules of a clearing process when it is provided by private sector

intermediaries, and is a characteristic that can vary from country to country and from system to system. Thus, when considering how a given country's payment system interacts with others, provisions for finality must be key.

Control of Intraday Credit. Few payment transactions are completely risk-free. Intraday credit extensions are often a byproduct of both real time gross settlement systems and net settlement systems. They occur whenever payments are made without cover at a moment in time. Credit extension is not bad-- it is, after all what banking is all about. But it is essential that payments system participants and operators set limits on the level of credit they are willing to assume--and put systems and procedures in place to monitor and control that exposure.

Three types of controls have been used: outright prohibition; capping using bi-lateral credit limits, net debits caps or collateral; and pricing. In theory, intraday credit can introduce the risk that money will not be there at the close of the system; in reality, intraday credit may be necessary to address liquidity needs in payment systems with very high turnover. Thus, some compromise between the needs of participants, their financial health and the level of intraday credit allowed may need to be considered, though some systems like the Swiss Interbank System have, by and large, functioned well without intraday credit. One word on pricing. Intraday credit has been priced explicitly in the U.S. for much of this year and has provided some incentive to speed up back-office

processes particularly for securities transfers. However, to the degree that this extra cost in the payments system causes payments to flow through less secure alternatives, or perhaps with less finality, I wonder whether this control achieves a desirable affect.

Effective Oversight. I see an oversight role for both Central Banks and private sector payment system participants. As I noted earlier, central banks are critical to the provision of finality. They also seek to promote the "public good" aspects of the payment mechanism, for example broad and equitable access and high levels of efficiency. To do this, Central Banks must oversee the evolution of national payment systems and payment system law. In my view, and while this is certainly debatable, they should also be the supervisory agency over major participants. Payment system oversight cannot be a part-time activity for Central Banks, or one that is left in part to stand-alone bank supervisory agencies, large commercial banks, or software or hardware vendors. Central Banks are the guardians of financial stability, and payments systems are critical to maintaining stability. Thus it must be Central Bankers who are the leaders in national payment system development. That is not to say, however, that the Central Bank should provide a safety net for all payments systems, whether publicly or privately run. To do so particularly in private sector systems could encourage those systems to take on more risk than they would otherwise. The Central Bank's oversight role thus must be delicately

balanced between ensuring optimum payment system development, and minimizing the moral hazard implicit in a Central Bank guarantee.

Just as Central Banks have the responsibility to oversee a nation's payments system, so too do participants in privately run net settlement systems have the obligation to control how the system functions, who participates in it, and what the risks are to them from other participants. Commercial bank participants in net settlement systems cannot afford to assume that because the system is operated by a major intermediary, or is a common system used by others that all aspects of risk are well addressed. Participants must be knowledgeable about and comfortable with their rights and responsibilities. Moreover, net settlement systems should require participants to meet certain financial standards and to set limits on bi-lateral exposures.

Effective Back Office Processes and Contingency Planning.

While ostensibly mundane, effective back office processes and contingency planning are critical to payment systems. Payments system operations and associated risk control mechanisms rely on continuous, error-free operation of back-office systems. Technology provides many different options for payment systems, but there are a few absolutes. First, whatever the technology, in times of operational problems the capability to recover locally and at a remote location must exist, and must be able to be effected within reasonable amounts of time. These capabilities should be tested at least annually. Second, software should be well documented and supported by highly

qualified technicians. Third, payment communications should employ the high levels of security over both access and payment integrity. Fourth, back office processes, and the use of intermediaries should be streamlined to reduce settlement risk. The New York Foreign Exchange Committee recently found that internal back office procedures were the largest source of risk in foreign exchange settlement and that attention to these processes could create benefits in risk reduction that far outweighed prospective large changes in clearing systems. Finally, while there is certainly a trade-off between cost and technological support, failing to adequately provide such support to high-value payments systems presents a critical source of risk.

International Cooperation. Finally, in an ever more globally interconnected payments system, international cooperation among national payments systems is vital. Systems in one country must learn from the lessons of others, and must incorporate best practices in dealing with issues of risk and finality. This will typically involve the Central Bank interacting with its counterparts in other countries, as well as commercial bank interaction with national payment systems in which they may participate. I noted the existence of temporal risk earlier as it related to the settlement of foreign exchange transactions. If we are to address this risk, national payment systems must provide some level of coordination across time zones for linked transactions to be completed. That can happen only

with international cooperation in payment system development.

This process of international cooperation is well underway, at least for those countries involved in the BIS Committee on Payments and Settlement, and for countries in the European Economic Union. Over the last several years, four key documents have been prepared discussing the necessary features and considerations involved in multilateral netting systems, domestic payments systems, securities settlement systems and related Central Bank services. In response, Central Banks in Europe, Japan and the United States have all changed aspects of current systems, and implemented new processes that are consistent with the international consensus reflected in these reports. In this manner, the safety and integrity of each countries' major payments systems--and by extension of the international linkages among them--have been improved.

In closing, let me say that safe and efficient payment systems represent a constantly moving target. As the needs of participants change, as technologies evolve, as new sources of risk emerge, Central Banks, private sector participants and international organizations must also evolve in their thinking and in their approaches to managing risk. Our goal should be to create an environment of consistent and predictably high levels of payment system performance. It is only by achieving this level of perfection that financial and capital markets will thrive.

Thank you.