The Evolution of Payments in Europe, Japan, and the United States

Lessons for Emerging Market Economies

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Lessons from the evolution of payment systems in Europe, Japan, and the United States provide a useful guide for emerging market economies in improving their own payment arrangements to foster economic growth.
Summary findings

Some payment arrangements are more efficient than others in promoting economic growth in a market-based economy. The payment experience of industrial countries is diverse enough to identify those payment arrangements that provide the infrastructure for sustained growth and the emergence of market-based enterprise.

Based on the historical experiences of Europe, Japan, and the United States, a number of country attributes have led to the intensive use of different payment instruments and, in some cases, a different mix of private and public ownership and participation in the payment system. Such attributes include country size, population density, banking structure, legal framework, safety, and payment instrument pricing.

These attributes explain why Japan relies heavily on cash at the point of sale but uses electronic payments for bill payments and business transactions. They also are the reason Europe relies on credit-transfer giro payments for all types of transactions and the United States instead relies on checks. Finally, the fact that consumer payment needs were not met within the banking system led to the establishment of postal giros in Europe, while untimely business payments led to central bank involvement in payment processing in the United States.

Unmet user needs, inefficient payment arrangements, differences in payment instrument costs, and improper pricing of payment services will determine the future structure of payment systems in emerging market economies just as they have determined the evolution of payment systems in industrial countries. The authors discuss these issues and apply the lessons learned to payment arrangements in emerging market economies. Although the evolution of payments has taken decades in industrial countries, emerging market economies hope to complete the process in just a few years, and so will benefit by having a better "roadmap" for transforming their payment systems.
The Evolution of Payments in Europe, Japan, and the U.S.:
Lessons for Emerging Market Economies

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Bibliography

1. Introduction

Emerging market economies today face the need to upgrade their payment systems and initiate new payment arrangements in order better to provide the infrastructure necessary for sustained growth within a market-based economy. This process requires an integrated knowledge of enterprise and consumer needs, the necessary legal framework, the application of existing as well as new technologies, and an analysis of the monetary policy and risk implications associated with the various payment system design options that are available. The developed countries of Europe, Japan, and the U.S. have had over 150 years to transform their payment systems from one dominated by the use of precious metals (coin) and privately issued currency into one which relies on government issued currency and specialized paper payment instruments and finally into a modern system where card-based consumer payments and networks of electric communication systems have increasingly replaced both currency and paper payment instruments. In transforming their payment systems, today's emerging market economies have the opportunity to learn from the diverse payment experiences of developed countries.

The World Bank has recently been involved in initiatives to modernize the national payment systems in countries of Asia (China, India, Indonesia, Viet Nam), of Latin America (Brazil, El Salvador, Columbia), of Africa (Madagascar, Mozambique, Tanzania, Uganda, Kenya), of Eastern Europe (Poland, the Czech Republic, Slovenia, Albania), and countries of the former Soviet Union (Russia, Ukraine). In this paper, the payment experience of Japan, the U.S., and a number of developed countries in Europe are outlined in some detail and the differing evolution of their payment systems are contrasted. The purpose is to identify important country attributes that determine a nation's payment structure and illustrate the critical areas that will affect emerging market economies as they seek to modernize their own payment systems. These conditions include:

(i) The geographical size of a country and its population density (making the communication of payment information easy or difficult);

(ii) The concentration of the banking system and its interconnectedness (permitting greater movement of funds internally within a single entity rather than externally between separate entities);

(iii) The legal structure concerning rights and liabilities of payment participants (reducing risk for certain payment instruments but not others) and antitrust laws (affecting cooperation and competition among suppliers of payment services);

(iv) The influence of cultural factors such as crime rates (affecting the need for cash substitutes); and
(v) The role of economic factors that affect the tradeoff between risk and efficiency by type of transaction and payment instrument (reflected in relative payment costs, user convenience, payment timeliness, and the availability of payment alternatives).

These conditions have combined in different ways to strongly influence the evolution of the payment systems of developed countries and thus will also importantly influence the restructuring of payment systems in emerging market economies. Overall, most countries in Europe have evolved payment arrangements that tend to rely on electronic credit transfer giro payments, while Japan continues to rely heavily on currency transactions and the U.S. concentrates on debit-transfer check payments. Although all developed countries use some amount of all three of these payment instruments, along with credit and debit cards, the proportions used are quite different. The involvement of the central bank in the payment system of these countries has also differed. While virtually all central banks provide settlement for all payments, and most either operate or supervise domestic large value wire transfer networks, only a few central banks compete with commercial banks or postal giros in providing processing for relatively low value consumer and business payments.

The payment system reforms adopted by emerging market economies, and the role that their central bank will have in this process, will not follow exactly the experience of developed countries. However, the conditions which have importantly affected the basic payment structure of Europe, Japan, and the U.S. will also affect the evolution of payment arrangements in emerging economies. Importantly, knowledge of the payment experience and problems encountered in developed countries can serve to reduce problems for emerging economies as they restructure their payment systems. Emerging economies also benefit from having the opportunity of adopting modern, and proven, electronic payment arrangements that can largely sidestep the need to first pass through a stage of heavy reliance on paper-based payments. Fortunately, these countries have available to them different design options for modernizing their payment systems that were not available to developed countries. This design flexibility, however, is mitigated by the need for emerging economies to more rapidly transform their payment systems, over years instead of decades.

As the paper unfolds, a number of questions are in effect posed and answered, such as:

- What is the general relationship between the value of a payment, the type of transaction it represents, and the particular payment instrument used?
- How heavily do developed economies rely on cash for consumer transactions and what seem to be the main determinants of cash use across countries?
- Why have some developed countries come to rely on electronic payments while others still rely on paper-based payment instruments?
- Which payment instruments are expanding their share in total transactions and why?
- How are developed and emerging market economies tackling the problem of payment risk on large value payment networks and which approach is the most cost-effective in reducing risk?
• How have payment systems evolved in developed countries and what lessons learned here are applicable to emerging market economies?

• What has been the role of the central bank in the workings of the payment system and how can it be most effective in improving payment system operations?

• How have country-specific characteristics shaped the structure of national payment systems and what implications does this have for restructuring payment arrangements in emerging market economies?

In what follows, economic activities in an economy by consumers, businesses, and government are reduced down to a set of four primary types of payments and five basic types of payment instruments. This provides a useful framework for outlining and contrasting the current payment structures of Europe, Japan, and the U.S. To place these different payment structures and their development in a proper context, the historical evolution of payment arrangements in these countries is summarized. The purpose is to identify the major determinants of why these countries seem to have followed a different evolutionary path in the development of their payment systems and in the role played by their central bank. In the end, we suggest that had these countries been more similar in terms of their size, population density, banking structure, legal framework, culture, and pricing, then the outcome—as far as payment instrument use is concerned—would have been pretty much the same. Having identified the main determinants of developed countries’ payment systems, these are then applied as lessons for emerging market economies in restructuring their own payment systems. Payment reforms in a number of emerging market economies are surveyed and provide a look at how the experience of developed countries has been applied to date.

II. Economic activity, types of transactions, and payment instruments

Size of economic and payment activity. Gross national product (GNP) is an aggregate measure of economic activity. It represents the sum of all payments made to original factors of production (labor, physical capital, resources) and also equals the total value of all consumption, investment, and government expenditures. A country’s payment activity, however, includes both final expenditure on goods and services as well as all of the associated intermediate production and financial transactions. In any given year, the total value of a country’s payments far exceeds the value of its GNP.

This result is seen in Figure 1 which shows the ratio of the value of payments in a country to its GNP. The results for a number of European countries as well as Japan and the U.S. indicate that: (a) the value of payments is a multiple—sometimes a very large multiple—of GNP; (b) this multiple—reflected in the payment value/GNP ratio—has risen over the last decade; and (c) the level and growth of this multiple is due primarily to the level and growth of large value (typically financial payments) wire transfers rather than the more numerous and smaller value retail (consumer) payments. Figure 1 illustrates one way to gauge the size and importance of a country’s payment system and illustrates why issues of payment system risk have become increasingly important in developed countries over the last decade.
Figure 1. Ratio of annual value of funds transferred to GNP

**Note:** No retail transfer data are available for the first year for France, Germany, Italy and Japan

**Source:** BIS: Payment Systems in the G-10 Countries (various issues)

**Four types of payment transactions.** The many different types of payments associated with the consumption, investment, and government expenditures that make up GNP can essentially be classified into four categories:

1. Point-of-sale (POS) transactions by consumers;
2. Bill payments by consumers, business, and government;
3. Disbursements by consumers, business, and government; and

The types of transactions initiated at the point of sale (food, other retail) and for paying bills (housing, utilities, services) are well-known and do not differ markedly across countries. Disbursements are defined to include person-to-person transfers, business and government payroll payments, and government transfer payments. Financial market transactions will primarily reflect borrowings, repayments, asset purchases, and foreign exchange transactions (mostly for business).

**Matching transactions with payment instruments.** Generalizing, these four basic types of transactions are associated essentially with five different types of payment instruments in developed countries:
Four types of transactions
- Point-of-sale (POS)
- Bill payment
- Disbursement (payroll, transfers)
- Financial

Five payment instruments
- Cash (coin and currency)
- Cards (debit and credit)
- Check (debit transfer)
- GIRO (credit transfer)
- Wire transfer

Ranking the 4 types of transactions by their likely average value, POS would be the smallest, bill payments would be larger, disbursements would reflect an even higher average value, while financial transactions would clearly average the highest. The average value per transaction for these five payment instruments for Europe (an average of 11 European countries), Japan, and the U.S. are shown below. As seen, cash transactions have the lowest average value, debit and credit cards are next highest, followed by check and giro payments which are markedly higher, with wire transfer payments in the millions of dollars per transaction.

Average value per transaction for five payment instruments
(1993, in US$)

<table>
<thead>
<tr>
<th>Area</th>
<th>Cash</th>
<th>Card</th>
<th>Check</th>
<th>Giro</th>
<th>Wire transfer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Debit</td>
<td>Credit</td>
<td></td>
<td>(In millions)</td>
</tr>
<tr>
<td>Europe</td>
<td>6-14</td>
<td>52</td>
<td>91</td>
<td>3,405</td>
<td>14,423</td>
</tr>
<tr>
<td>Japan</td>
<td>25</td>
<td>165</td>
<td>163</td>
<td>79,754</td>
<td>3,820</td>
</tr>
<tr>
<td>U.S.</td>
<td>5</td>
<td>44</td>
<td>45</td>
<td>1,147</td>
<td>4,602</td>
</tr>
</tbody>
</table>

1 Boeschoten (1992), table 1-1, p.200.
2 Europe averages CHAPS (U.K.), SACITTAIRE and TBF (France), EAF (Germany), and ME (Italy); Japan is BOJNET; the U.S. averages CHIPS and Fedwire.

The match between transaction type and the payment instruments used for these transactions is related to the average value of the transaction and is illustrated below. Both check and giro payment methods are seen to be quite flexible in that they are often used for a wide range of payment values and transaction types. In contrast, cash and cards are typically tied to smaller value point-of-sale transactions while wire transfers are almost exclusively used for large value financial transactions.

1 A ranking is used because only scattered data are available on the actual average value of each of the 4 types of transactions.
2 The 11 countries are: Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Norway, Sweden, Switzerland, and the U.K.
3 Japan's average value per wire transfer is high because many of its transfers represent settlement payments for sums of transactions rather than individual transfers. Japan's average check value is high because it is almost exclusively used for a small number of large value business/financial transactions.
The association between transaction type and payment instrument used reflects a tradeoff between the efficiency or cost of using a certain type of payment instrument and the risk from loss or fraud associated with the transaction itself. Risk is higher when transaction values are large and/or crime rates are high. This obviously explains the use of (secure) wire transfers for large value payments. Although the actual cost of a wire transfer is seemingly quite high (on the order of $10 to $20 or more per transfer), this cost is extremely small relative to the value of the transaction and is also less than the losses that could be realized if a lower cost—but more risky and potentially less timely—payment method were used. Thus the choice of payment instrument is influenced by the relative price or cost faced by the user as well as the technical feasibility of actually substituting one instrument for another to complete a particular type of transaction. Cost, of course, is both explicit (external price plus internal expense) as well as implicit (risk assessment, convenience, availability, and timeliness).

### Association between the average transaction value, transaction type, and payment instrument used

<table>
<thead>
<tr>
<th>Average transaction value</th>
<th>Transaction type</th>
<th>Payment instruments used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small value</td>
<td>POS</td>
<td>Cash, debit and credit card, check</td>
</tr>
<tr>
<td>Intermediate value</td>
<td>Bill payment</td>
<td>Check, giro (and direct debit)</td>
</tr>
<tr>
<td>Larger value</td>
<td>Disbursement</td>
<td>Check, giro (and direct deposit)</td>
</tr>
<tr>
<td>Largest value</td>
<td>Financial</td>
<td>Check, giro, wire transfer</td>
</tr>
</tbody>
</table>

The tradeoff between efficiency and risk is also an important reason why the U.S. and some other countries have reduced their use of cash at the point-of-sale (high crime rate) while Japan continues to rely heavily on cash for these same transactions (low crime rate). When risk is low, as it generally is for smaller value transactions, then differences in relative efficiency or cost will primarily determine the type of payment instrument used for these transactions.

### III. The use of cash in developed countries

The limited data that are available all suggest that cash transactions represent a large percent of the number or volume of transactions but a very small percent of the value. Cash transactions are estimated to represent 78% of the volume of all transactions in the Netherlands, 83% in Finland and the U.S., 86% in Germany, and 90% in the U.K. (Boeschoten, 1992; Humphrey, 1984; Virén, 1993). In value terms, cash transactions would account for less than 5%, and in the U.S. less than 1%, of payment expenditures.

**Cash holdings as an indicator of cash use.** As data on the volume or value of cash transactions (a flow) are very sparse, the use of cash for payment transactions is instead inferred from the value of
cash holdings (a stock), either relative to the money supply (M1) or relative to GDP. These ratios, with the largest values underlined, are shown below for Europe, Japan, and the U.S. for 1993.

<table>
<thead>
<tr>
<th></th>
<th>Cash/M1</th>
<th>Cash/GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td>.14</td>
<td>.04</td>
</tr>
<tr>
<td>Japan</td>
<td>.27</td>
<td>.08</td>
</tr>
<tr>
<td>U.S.</td>
<td>.11</td>
<td>.02</td>
</tr>
</tbody>
</table>

Indicators of cash use, 1993

Cash holdings in Japan are effectively twice those in Europe or the U.S., suggesting a much greater use of cash for payments. But Europe is far from homogeneous. Within Europe, Switzerland, the Netherlands, and Belgium all have a higher currency/M1 ratio than Japan while Sweden, Norway, Denmark, the U.K., and Finland have a lower ratio than the U.S. This result is evident from Table 1 which shows the cash/M1 and cash/GDP ratios for 14 countries during 1993 as well as a decade earlier.  

Changes in the use of cash over time. Comparing the level of these ratios between 1983 and 1993, the ratio of cash to M1 fell—sometimes dramatically so—for all but one European country (Italy), rose slightly in Japan, and was constant in the U.S. Similar results were obtained for the ratio of cash to GDP over the same period: this ratio fell for all but one European country (Germany) while both Japan and the U.S. experienced a slight rise. The clear implication from changes in these two ratios is that cash use is falling in Europe.

An alternative way to illustrate the reduction in cash use is to compare the value of cash holdings per person (in constant U.S. dollars) with the number of non-cash transactions per person. Across countries, a high number of non-cash transactions per person is associated with a low stock of cash per person (comparing Column 8 with 6 in Table 1). The estimated relationship across 14 developed countries annually over 1987-93 suggests that a 6.8% rise in non-cash transactions is associated with a 10% reduction in cash holdings (Humphrey, Pulley, and Vesala, 1996).

European data reflects the total U.S. dollar value of coin and currency (1993 exchange rate) for 11 countries divided by the total dollar value of M1 or GDP. It is equivalent to a weighted (not a simple) average of individual country ratios.

Since cash balances can be held for prudential or speculative purposes (hoarding), in addition to pure transaction purposes, observed levels of cash holdings only approximate the level of cash use. Cross-country evidence suggests that hoarding is especially important in Switzerland, the Netherlands, and Germany but not important in Denmark, Finland, France, Norway, or the U.K. (Boeschoten, 1991 and 1992). As seen in Table 1, countries where hoarding is thought to be important also have relatively large cash/M1 and cash/GDP ratios distorting, somewhat, the implied differences in cash use across countries.

The results for Germany and the U.S. must be taken with caution since it has been estimated that perhaps 35% of the value of German currency and 60% of U.S. currency is held outside the country (Boeschoten, 1992; Porter and Judson, 1995). Only if these percentages have remained stable over 1983-93 is it possible to accurately infer domestic use of cash in either the cash/M1 or cash/GDP ratios.
Table 1. Cash holdings and annual non-cash transactions per person

<table>
<thead>
<tr>
<th>Country</th>
<th>Cash (^1) to M(^1)(^2) ratio</th>
<th>Cash to GDP ratio</th>
<th>Value of cash holdings per person (U.S. 1993 dollars)</th>
<th>Non-cash transactions per person</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switzerland</td>
<td>.35</td>
<td>.34</td>
<td>9.90</td>
<td>7.86</td>
</tr>
<tr>
<td>Netherlands</td>
<td>.33</td>
<td>.25</td>
<td>6.52</td>
<td>6.49</td>
</tr>
<tr>
<td>Belgium</td>
<td>.41</td>
<td>.30</td>
<td>9.12</td>
<td>5.95</td>
</tr>
<tr>
<td>Italy</td>
<td>.15</td>
<td>.16</td>
<td>6.37</td>
<td>5.75</td>
</tr>
<tr>
<td>Sweden</td>
<td>.10</td>
<td>.09</td>
<td>6.21</td>
<td>4.63</td>
</tr>
<tr>
<td>Norway</td>
<td>.33</td>
<td>.10</td>
<td>5.41</td>
<td>4.61</td>
</tr>
<tr>
<td>Germany(^4)</td>
<td>.23</td>
<td>.20</td>
<td>3.53</td>
<td>3.89</td>
</tr>
<tr>
<td>France</td>
<td>.17</td>
<td>.15</td>
<td>5.08</td>
<td>3.58</td>
</tr>
<tr>
<td>Denmark</td>
<td>.12</td>
<td>.09</td>
<td>3.01</td>
<td>2.88</td>
</tr>
<tr>
<td>U.K.</td>
<td>.26</td>
<td>.08</td>
<td>3.72</td>
<td>2.84</td>
</tr>
<tr>
<td>Finland</td>
<td>.26</td>
<td>.07</td>
<td>2.07</td>
<td>1.97</td>
</tr>
<tr>
<td>Japan</td>
<td>.25</td>
<td>.27</td>
<td>7.59</td>
<td>8.43</td>
</tr>
<tr>
<td>Canada</td>
<td>.29</td>
<td>.20</td>
<td>3.16</td>
<td>3.43</td>
</tr>
<tr>
<td>U.S.(^4)</td>
<td>.11</td>
<td>.11</td>
<td>1.79</td>
<td>2.06</td>
</tr>
</tbody>
</table>

Sources: IMF: International Financial Statistics, BIS: Payment Systems in the G-10 Countries (various issues)

1. Cash held by the public (equals currency and coin in circulation less that held by the banking system and the government).
2. M\(^1\) equals demand deposits (transferable deposits) plus cash (defined above).
3. The 1983 figures are deflated using changes in each country's CPI.
4. It is estimated that 35% of German currency and 60% of U.S. currency is held outside these countries, and the figures are adjusted accordingly (Boeschoten, 1992; Porter and Judson, 1995).

Cash holdings and availability of POS and ATM terminals. The decreased reliance on cash for transactions is associated with the increased availability of credit and debit card terminals at the point of sale. This is seen in Figure 2(a) which illustrates the negative and statistically significant relationship between the availability of electronic funds transfer (EFT) POS terminals (terminals that accept credit and debit cards) across 14 developed countries and the ratio of cash holdings to GDP for 1993 ($R^2 = .21$). The increased availability of EFT-POS terminals leads directly to increased use, as evidenced from a very similar significantly negative relationship in Figure 2(b) between the annual number of EFT-POS transactions per person and the same cash/GDP ratio ($R^2 = .25$). Income and interest rates also affect the use of cash. The positive effect of national income is controlled for by our measurement strategy (cash/GDP) while the opportunity cost of holding cash is included. The correlation coefficient between the average of the monthly three-month money market rate (1987-1993) and the value of cash outstanding per person (1993) is -0.64 for the countries shown in Table 1.
While debit and credit card transactions on POS terminals can directly substitute for cash payments, ATMs make it easier to obtain cash: this can have two opposite effects on cash holdings. By making cash more accessible, ATMs would permit consumers to increase their use of cash for smaller value transactions and so may raise cash holdings. Alternatively, the greater convenience of ATMs as a way of obtaining cash may mean that consumers withdraw smaller amounts each time and make up the difference by visiting an ATM more frequently, and so may on balance reduce average cash holdings. The relationships shown between cash holdings and the number of ATM terminals in Figure 3(a) and the number of ATM transactions in Figure 3(b) is in both cases insignificantly negative or positive (neither R² is greater than .02). Thus, in this cross country comparison, ATMs have no significant effect on cash holdings (in contrast to the EFT-POS results where cash holdings are reduced).

Source: BIS: Payment Systems in the G-10 Countries, 1994

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7 Most ATM transactions are cash withdrawals. In the U.S., for example, 86% of ATM transactions are cash withdrawals, 10% are deposits, 3% are account transfers, and 1% are bill payments (Board of Governors of the Federal Reserve System, 1991).
This analysis supports the conclusion that in most major developed countries except Japan, cash is being increasingly replaced by card-based electronic point-of-sale payment methods—such as credit and debit cards—brought about by the increased availability of EFT-POS terminals. Econometric analysis supports this contention and also suggests that a heavy reliance on cash for POS transactions, as in Japan, is associated with having a low rate crime rate. As well, the substitutability of credit cards for cash is viewed as also being dependent upon pricing and a country's cultural attitude toward credit. Since per transaction credit card fees are largely borne by retailers that accept them for payment, credit cards are perceived by consumers as a low cost, delayed payment substitute for an immediate cash payment. Electronic cash loaded on chip cards or transmitted through open

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8 Countries that have the highest incidence of credit card use per person (the U.S. and Canada) also have a culture in which personal credit is quite acceptable. The cultural acceptability of credit cards is lower in Europe in part because of a history of relying on savings (rather than credit) for many consumer expenditures. This tradition is reinforced by a historical European reliance on giros—a method of immediate and final payment—for consumer bill payments. Giro transactions rarely involve the extension of credit while payments by check—a
computer networks can develop into a strong substitute for cash in the future. However, at the moment the necessary infrastructure for the adoption of e-cash is still by and large under development.

IV. The composition and growth of non-cash payments in developed countries

Non-cash payment instruments include checks, credit and debit cards, giro payments, and wire transfers. Although wire transfers account for the vast majority of the value of non-cash payments in countries that have such a network, they represent a very small part of non-cash payment volume. Thus our focus here will be on the other non-cash payment instruments, with wire transfers deferred until later when the issue of payment risk and the role of the central bank are addressed.

The composition of non-cash payments. The number and composition of non-cash transactions per person differs considerably between Europe, Japan, and the U.S. As seen below, the annual number of non-cash transactions per person in Europe in 1993 was 113. This was less than half that of the U.S. (at 292) while Japan's use (at 39) was just over a third of that for Europe. The exceptionally low annual use of non-cash payments in Japan is consistent with its reliance on cash for most of its point-of-sale payments.

The composition of non-cash transactions clearly shows that the U.S. is the heaviest user of checks and credit cards while Europe is the heaviest user of debit cards and giro payments (underlined values). Japan falls somewhere in between Europe and the U.S., or lower, in its per person use of each payment instrument (a result of heavy use of cash).

Annual number and composition of non-cash transactions per person, 1993

<table>
<thead>
<tr>
<th></th>
<th>Total*</th>
<th>Check</th>
<th>Credit card</th>
<th>Debit card</th>
<th>Giro</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td>113</td>
<td>32</td>
<td>4</td>
<td>10</td>
<td>67</td>
</tr>
<tr>
<td>Japan</td>
<td>39</td>
<td>3</td>
<td>5</td>
<td>.1</td>
<td>31</td>
</tr>
<tr>
<td>U.S.</td>
<td>292</td>
<td>234</td>
<td>49</td>
<td>2</td>
<td>9</td>
</tr>
</tbody>
</table>

* Data have been rounded off and may not add to the total.

Paper versus electronic payments. An alternative way to view the same information is in terms of paper-based versus electronic payments. Checks and paper giro payments comprise paper-based payment instruments while credit cards, debit cards, and electronic giro payments comprise electronic payments. As seen below, the U.S. is clearly characterized as having a paper-based payment system since the number of paper-based payments per person is 5 times that of Europe and deferred and provisional payment—provide for a short (1 to 2 day) extension of credit before a customer's account is actually debited.

In the U.S., wire transfers account for 86% of non-cash payment value but less than 0.2% of the volume.
26 times that of Japan. Overall, only 20% of U.S. non-cash transactions are electronic. But, because the U.S. has so many more non-cash transactions than does either Europe or Japan, the actual number of U.S. electronic payments exceeds that of Japan and is close to that of Europe. As seen above, the U.S. initiates more card-based POS payments per person (51) than does Europe (14) or Japan (5) but this higher use of electronic payments by the U.S. at the point of sale is offset in Europe by greater use of electronic giro bill payments and disbursements—types of transactions that are dominated by checks in the U.S.

Annual number of paper and electronic non-cash transactions per person, 1993

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Paper*</th>
<th>Electronic**</th>
<th>% electronic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td>113</td>
<td>44</td>
<td>68</td>
<td>61</td>
</tr>
<tr>
<td>Japan</td>
<td>39</td>
<td>9</td>
<td>31</td>
<td>78</td>
</tr>
<tr>
<td>U.S.</td>
<td>292</td>
<td>234</td>
<td>59</td>
<td>20</td>
</tr>
</tbody>
</table>

* Checks, paper giro. ** Credit and debit cards, electronic giro.

The tradeoff between cash holdings and non-cash payments. Figure 4 illustrates where developed countries were in both 1987 and 1993 in terms of holding cash and using electronic versus paper-based payment instruments. The figure is divided into four quadrants based on the average percent of non-cash electronic payments (61.4%) and the average cash to GDP ratio (4.6%) over 14 developed countries in 1993. An arrow is drawn from the point each country was in 1987 to the point it moved to in 1993, showing how cash holdings and the use of electronic payments has changed over this seven-year period.

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10 Figure 4 updates and adds to an earlier figure developed by Yamaguchi (1993).
Figure 4. Percent of electronic payments and cash to GDP ratios, 1987 and 1993

At either point in time, most countries fall into the lower left and upper right quadrants, indicating that most countries either use mostly paper-based non-cash payments and little cash (U.S., Canada, France, and the U.K.) or use mostly electronic non-cash payments and have high cash holdings (Sweden, Belgium, the Netherlands, Switzerland, and Japan). In contrast, 3 countries use mostly electronics and have low cash holdings (Finland, Denmark, and Germany) while 2 countries appear to rely strongly on paper-based non-cash payments and also have relatively high cash holdings (Italy and Norway). Except for Japan, all countries have increased their relative use of electronic non-cash payments and all but the U.S., Canada, and Italy have at the same time reduced or essentially maintained their cash holdings as a percent of GDP. Overall, it is clear that the general trend in Figure 4 over 1987-93 has been to shift from holding cash to an increased use of electronic payments.

The growth in non-cash payment instrument use. The level and growth in non-cash transactions for 14 developed countries are illustrated in Figure 5. Each bar in the figure shows the total number of non-cash transactions per person in each year over 1987-93. All but two European countries (Italy and Switzerland, both of which have high cash holdings) initiate a similar number of non-cash transactions. The number of non-cash transactions in Europe is less than half that of the U.S. while those of Japan are only one-third of those of Europe. The growth in non-cash transactions is
illustrated by comparing the height of the bars over time. Comparing 1987 with 1993, the number of non-cash transactions, although varying, has risen for all countries.

The shaded portion at the bottom of each bar indicates the number of check payments per person in each year. Annual check use per person in 1993 is by far the largest in the U.S. (at 234 transactions per year). France (with 85 transactions), Canada (with 76), and the U.K. (at 50) also rely on checks but their use is less than one-third that of the U.S. Importantly, for 12 of the 14 countries, check use per person has reached a peak and is falling.

The solid portion in the middle of each bar in Figure 5 shows the annual number of card (credit plus debit) payments per person while the open portion at the top shows the number of giro payments. As seen, the number of card transactions per person has been expanding in all countries over 1987-93. Although not shown separately in the figure, the annual number of credit card transactions per person are highest in the U.S. (with 49), followed by Canada (37), and then the U.K. and Finland (who both have 13). Annual debit card transactions per person are highest in Finland (at 30), followed by France and Denmark (who both have 27), and finally Norway (18). Giro payments per person (at the top of each bar) are much greater than card transactions. The largest user of giro payments is the Netherlands (at 128 per year), followed by Germany (124), with Finland and Sweden tied for third (75).

Figure 5. Annual number of checks, credit & debit cards and giro transactions per person (14 developed countries)

Each country: Yearly figures 1987 to 1993

The exceptions are the U.S. and Germany. However, since only 11 checks per person are written each year in Germany, the fact that check use here has not fallen is of little consequence.
The number of paper and electronic non-cash transactions for these developed countries is illustrated in Figure 6. Paper-based non-cash payments (checks and paper giro) are shown in the open portion of each bar while electronic payments (credit and debit cards, electronic giro) are indicated by the solid portion. The number of electronic payments per person has risen in all countries over 1987-93. Indeed, electronic payments are the only source of growth of non-cash payments in 11 countries and the primary source of growth in two of the remaining three (Japan and France, not the U.S.). As a result, the prime mover behind the rise in non-cash transactions for all countries but the U.S. has been the rise in electronic payments. But even the U.S. is forecasted to follow this trend by the turn of the century since the annual number of check payments per person is forecasted to start falling within the next five years. When this occurs electronic payments will be the main reason behind the growth of non-cash transactions in the U.S. as well.

Figure 6. Annual number of non-cash, paper and electronic transactions per person
(14 developed countries)

Without neglecting significant cross-country differences in payment evolution, certain universal trends can be identified. First, cash is losing ground to non-cash payments, mostly to electronic card-based payments that are close substitutes for cash at the point-of-sale. Prepaid cards and smart cards also play a role here but their use is still at an early stage. Second, within the category of non-cash payments, checks are being replaced both by POS card-based payments and, to a lesser extent, electronic credit transfers through giro or ACH networks. And finally, all paper-based payment instruments are being replaced by lower cost electronic transactions. These trends in payment instrument substitution have been affected by a variety of country-specific institutional, economic, and demographic differences across countries, which is the reason why some countries are further ahead in this process than others. These differences are taken up in Section VI, below, where the historical evolution of payments in Europe, Japan, and the U.S. are discussed in some detail.
V. Large value payments in developed countries and the role of the central bank

In developed countries which have large domestic and/or international money markets, time-sensitive high value payments are typically sent over separate, secure, immediate payment, electronic interbank wire transfer networks. While the U.S. Fedwire network evolved from early telegraphic, final payment arrangements for settling interbank interregional consumer and business check payments using central bank offices, other networks—such as CHIPS (U.S.), CHAPS (U.K.), and BOJ-NET (Japan)—evolved as a more secure and timely extension of bank clearing house check (non-final) payment arrangements.

The average value of a payment over a wire transfer network is quite high, averaging $4.9 million (U.S. dollars) in Europe for 1993, 12 $93.1 million for Japan, and $4.2 million for the U.S. 13 The volume, value, and average value per wire transfer for 9 networks across 7 developed countries are shown in Table 2. 14 The value of wire transfers in these countries ranges from 11 times the country's GDP to 100 times GDP. With such large values being transferred over wire transfer networks, the disruption of economic activity and/or risk of loss associated with the failure of participants on these networks is a major concern.

Table 2. Selected large value wire transfer systems, 1993 (annual data)

<table>
<thead>
<tr>
<th>Country</th>
<th>System</th>
<th>Owner/manager</th>
<th>Settlement</th>
<th>Volume (millions)</th>
<th>Value (US$ billions)</th>
<th>Average value (US$ millions)</th>
<th>Value to GDP</th>
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</thead>
<tbody>
<tr>
<td>France</td>
<td>SAGITTAIRE</td>
<td>CB</td>
<td>Net</td>
<td>3.9</td>
<td>19,204</td>
<td>4.9</td>
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<td></td>
<td>TBF</td>
<td>CB</td>
<td>RTGS</td>
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<td>52,412</td>
<td>4.4</td>
<td>42</td>
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<td>Germany</td>
<td>EAF</td>
<td>CB</td>
<td>Net</td>
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<td>7.2</td>
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<td>CB</td>
<td>Net</td>
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<td>10,846</td>
<td>5.7</td>
<td>11</td>
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<td>RTGS</td>
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<td>Net</td>
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<td>35,353</td>
<td>3.2</td>
<td>37</td>
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<tr>
<td>Japan</td>
<td>BOJ-NET</td>
<td>CB</td>
<td>Net &amp; RTGS</td>
<td>3.8</td>
<td>353,818</td>
<td>93.1</td>
<td>84</td>
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<td>U.S.</td>
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<td>CB</td>
<td>RTGS</td>
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<tr>
<td></td>
<td>CHIPS</td>
<td>B</td>
<td>Net</td>
<td>42.2</td>
<td>262,256</td>
<td>6.2</td>
<td>41</td>
</tr>
</tbody>
</table>

1. CB = Central Bank; B = Banks; 2. Net = Multilateral net settlement; RTGS = Real time gross settlement
Source: BIS: Payment Systems in the C-10 Countries, 1994

12 This figure represents an average of payment values over 5 wire transfer networks: CHAPS (U.K.), SAGITTAIRE and TBF (France), EAF (Germany), and ME (Italy). The SIC network in Switzerland transfers both large and smaller value payments (with an average value of only $0.3 million) and was excluded because data are not reported separately for large value payments.

13 Japan is represented by BOJ-NET while the U.S. figure is an average of CHIPS and Fedwire.

14 Other large value wire transfer networks exist and are illustrated in Bank for International Settlements (1994), Table 10b.
**Settlement failure and policies to contain systemic risk and daylight overdrafts.** The risks associated with a settlement failure on a wire transfer network differ depending on how payments are settled. On a net settlement network, payments are sent and received during the business day and only the net position of each participant is settled at the end of that day (or the next day). On a real time gross settlement (RTGS) network, each payment sent is settled when it is made. Of the 9 major wire transfer networks outlined in Table 2, 5 have employed net settlement (SAGITTAIRE, EAF, ME, CHAPS, CHIPS) while 3 are RTGS (TBF, SIC, Fedwire). One network handles both net settlement and RTGS payments (BOJ-NET).

Until recently, the failure of a participant on a net settlement network would typically have led to the unwinding or reversal of all of that day's payments and receipts by the failed participant. The remaining participants would then be faced with trying to settle a recalculated net debit or credit position—recalculated after excluding the payments and receipts of the failed participant. This would not be a problem if receivers of funds did not use them—by releasing them to customers—until after the day's transactions were settled. However, because of the float cost of waiting until the next morning to use the funds received, receivers typically use funds before the transactions are finally settled.

If there is an unexpected settlement failure, then it may not be possible for other participants on the network to obtain sufficient funds to settle their recalculated net debit or credit positions. Indeed, in simulations performed for the CHIPS net settlement network using actual payment data (Humphrey, 1986), the increases (decreases) in other participants' net debit (net credit) positions in many cases exceeded their capital levels. Faced with either (a) settling their recalculated payment position by effectively selling or pledging the entire value of their capital or (b) not settling and having their own payments and receipts that day unwound from the settlement, it is clear that the logical choice would be (b).

The possibility of a domino-like series of settlement failures is termed systemic risk. In simulations using CHIPS data, the failure of one randomly chosen participant led to the failure to settle of almost one-half of the over 100 CHIPS (domestic and international bank) participants. It also led to the elimination of around one-third of that day's payments of $885 billion. However, similar simulations for an Italian wire transfer network led to a much smaller number of additional failures and a correspondingly smaller reduction in payment value (Angelini, Maresca, and Russo, 1996). As the value of payments over the Italian network were much smaller, so were the participant net debit/capital ratios. Thus systemic risk is smaller when a country does not have a large and well-developed domestic money market (so interbank net debits are not absolutely large) and when a country's banking system is highly concentrated (so that bank capital levels are more likely to cover net debits).

One way to effectively eliminate systemic risk on a net settlement network is to have each participant post collateral sufficient to cover their net debit position. Payment flows would be monitored in real time and payments that would push a participant's net debit above its collateral value would be rejected. If there were a failure to settle, the collateral would be liquidated to obtain a central bank loan to make settlement. CHAPS, established in 1984, plans to have all net debits fully collateralized by 1997. Participants on CHIPS (established in 1971) have since 1990 posted collateral sufficient to cover the single largest net debit permitted to occur on that network. The CHIPS approach eliminates systemic risk if there is a failure to settle by one participant whereas the CHAPS
approach eliminates systemic risk if there are multiple failures to settle. Both CHIPS and CHAPS were initially set up as net settlement networks to clear large value checks electronically and are owned by large banks in New York and London, respectively.

There is no systemic risk on a real time gross settlement wire transfer network. This is because each payment is finally settled when it is made, rather than net-settled at the end of the day. However, if a participant can send payments without having sufficient funds in their account, then a daylight overdraft is created. The risk on a RTGS network concerns the possibility that a participant with a daylight overdraft may fail, creating credit risk for the operator of the network who guarantees the finality of each payment as it is made.

RGTS networks are operated by central banks who can face credit risks associated with daylight overdrafts. Except for SIC in Switzerland, the networks in Table 2 permit daylight overdrafts but control credit risk by requiring that collateral be available to cover these exposures. This also serves to reduce moral hazard-type behavior by payment participants since their collateral is at risk if they fail to settle. In Germany and the Netherlands, daylight overdrafts with the central bank must be fully collateralized. In France, overdrafts may be partially uncollateralized without a fee being charged and net debit caps establish a ceiling on the overdrafts participants may incur. Collateralization limits central bank risk to the difference between the face value and the market value of the collateral.

The SIC RTGS system in Switzerland (established in 1987) represents a different RTGS arrangement and avoids daylight credit risk by rejecting any payment request which would lead to a daylight overdraft. If sufficient funds are not available, payment orders are put into a queue until the payment request can be covered, either by borrowing or waiting until sufficient funds have been received during the day. Queued payments are sent and settled on a first-in-first-out basis (Vital, 1990). Sometimes, if a bank's balance would not cover the entire value of a large payment, the payment is divided up and sent in pieces as sufficient covering funds become available. This procedure reduces the possibility of a payments “gridlock”, as could conceivably occur if enough sending participants chose not to hold an idle balances sufficient to cover their payment activity.

Fedwire was established in 1918 as a telegraphic system and has always been an RTGS network. Before the 1980s, account monitoring had always been at the end of the day. As total payment values were smaller and reserve requirements were higher than today, there was little likelihood of a daylight overdraft even though balances were not monitored intraday. However, the exponential growth in payment values associated with a dramatic expansion of domestic money market activity led to daylight overdrafts and steps were taken to contain their growth and the credit risk to the central bank.** Currently, Fedwire permits overdrafts (up to a given multiple of a

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15 While the positive opportunity cost of an idle balance provides an incentive to hold fewer balances, the loss of business associated with an inability to make a payment when ordered by a customer has, in practice, apparently been a stronger incentive and gridlock has not been a problem.

16 Since payment values associated with the production of goods and services that underlies GDP should only grow in rough proportion to GDP, the expansion of purely financial transactions associated with money market activity is the proximate cause of the exponential growth in wire transfer payment values. Although initial payments may take another form, such as checks written to clearing corporations or depositories, Fedwire is used to ultimately settle almost all stock, bond, option, and futures market trades in the U.S. and these activities
participant's capital) and in 1994 assessed a fee for the provision of this daylight liquidity. At present, the fee is low enough so that the central bank is the only direct supplier of daylight liquidity. If the central bank fee were sufficiently higher, however, then something like an intra-day interbank funds market would likely arise, similar to existing markets for overnight interbank funds.

Japan's BOJ-NET large value network, established in 1988, can accommodate payments to be net settled as well as RTGS payments. Like the Swiss SIC system, the RTGS part of BOJ-NET does not permit any daylight overdrafts and transfers without sufficient covering funds are rejected.

In Europe, the implementation of RTGS systems started in the late 1980s. Some systems were devoted only to large value interbank transfers, while others were designed to handle both retail and large value payments. For example, the Netherlands' FA was established in 1985 and Sweden's RIX in 1986. However, the biggest large value systems—CHAPS in the U.K., EAF in Germany, and SAGITTAIRE in France—continued to operate on a net settlement basis and only recently have started to implement RTGS procedures. A phased implementation of RTGS on CHAPS began at the end of 1995 and EAF is being modified (new EAF2) to offer early and intraday settlement finality as in a RTGS system. In France, payments exchanged over SAGITTAIRE and three additional net settlement networks are being shifted to the new TBF RTGS system (established in 1992). Overall, the trend in Europe toward RTGS arrangements has been strongly influenced by the European Commission which declared that RTGS should be adopted on each country's large value payment network in order to eliminate systemic risk and thus facilitate the harmonization of large value payment systems across Europe.

The role of the central bank. Central banks in developed countries all provide for the settlement of different types of non-cash payment instruments: checks, credit cards, debit cards, and wire transfers. Central bank settlement of giro transactions is unnecessary since funds are merely being transferred between accounts held within a single organization and so settlement is internal. Of experienced rapid growth since the 1970s. Transfers of U.S. government securities, which is a book-entry delivery-against-payment system, uses the security transfer portion of Fedwire. See, for example, Stehm (1996).


On BOJ-NET, RTGS transactions represent only 3% of transaction volume. Designated time transactions, which are equivalent to transfers over a net settlement network, generate 97% of the volume. These transactions occur during the day (rather than end-of-day) and are used to settle check clearings, ACH (Zengin) clearings, foreign exchange clearings, and interbank transfers.

In a follow-up document published in late 1993, the Working Group on EC Payment Systems to the Committee of the EC Central Bank Governors noted that "...every Member State should have as soon as possible an RTGS into which as many large value payments as possible should be channelled". It was acknowledged, however, that payment netting arrangements may continue to exist parallel to RTGS systems provided that (i) they settle on a same-day basis, and (ii) fully meet the Lamfalussy standards published earlier for net settlement networks (modeled on the arrangements originally developed for CHIPS in the U.S.).

The exception would be a transaction between (say) a member of a postal giro and a member of a bank giro in the same country which would likely require central bank settlement.
course, if a giro did not have some type of centralized accounting, then funds transfers between customers of separate giro offices would have to be settled externally through the central bank. The same would be true for funds transfers between different branch offices of a single bank which did not centralize its account information, a not uncommon situation in emerging market economies.

The major point of departure regarding the role of a central bank in a developed country's payment system concerns the extent to which the central bank provides payment processing services for other than large value wire transfers. Central banks in Europe and Japan do not provide payment processing for checks, ACH, credit cards, debit cards, or giro payments while the U.S. central bank competes with banks, bank clearing houses, and non-bank payment processors in the processing of check and ACH transactions. The reason for the different roles played by developed country central banks, and the reasons why Europe, Japan, and the U.S. have come to rely on a different mix of payment instruments, is largely related to their different historical experiences. The main elements concerning this differential experience are now outlined.

VI. The historical evolution of payments in Europe, Japan, and the U.S.

The payment systems of all developed countries have passed through a stage where barter was replaced by coin (gold, silver, copper) and then was itself almost totally replaced by currency. Europe, Japan, and the U.S. have all experienced a similar evolution up to this point. However, beyond this point the evolution starts to differ.

For POS payments, Japan clearly remains a heavy user of cash while Europe has reduced its cash use by first using some checks at the point-of-sale and more recently has expanded its use of debit cards. The U.S. has experienced a more rapid and greater reduction in cash use at the point-of-sale, relying heavily on checks and, more recently, an increased use of credit cards.

For consumer bill payments, payroll disbursements, and financial transactions, Japan, Europe, and the U.S. all have a long history of initially using cash combined with specialized paper drafts. Subsequently, payment arrangements evolved—at different rates for different instruments—away from cash and into a heavy reliance on paper drafts (checks, bills of exchange, and paper giro payments).

21 ACH transactions are the electronic equivalent of a paper check. In the U.S., ACH transactions are mostly debit transfers but some credit transfers also exist (and are thus equivalent to a giro payment in Europe). With respect to credit and debit card processing, banks own or supervise the processing of bank-based card transactions while non-bank processors typically handle the processing of non-bank (e.g., retail store, gas station) credit card payments.

22 While a check and a bill of exchange are similar, there is one crucial difference. A check is an unconditional order in writing by a person (the payor) to the payor's bank, signed by the payor, requiring the bank to pay a certain sum on demand to a payee listed on the check or to the bearer of the check. A bill of exchange is the same thing except that the payor orders another person—rather than a bank—to pay funds to the payee at a given future date. For example, if in the process of trade firm 1 owes money to firm 2, and firm 2 owes money to firm 3, a bill of exchange can be drafted and signed by firm 2, drawn on firm 1, for firm 1 to transfer a given amount on a given date to firm 3. Instead of transferring deposits, firm 2 (the payor) is transferring trade credit from firm 1 (the "bank") to firm 3 (the payee).
More recently, the evolution has been away from paper and into electronics (electronic giro, direct debits, direct deposit, and wire transfers).

Although the evolution of payments among these countries has been qualitatively similar, there are large quantitative differences. Simply put, the key distinction in payment instrument use between Europe, Japan, and the U.S. is that Europe relies on giro payments, Japan relies on cash, and the U.S. relies on checks. These differences are most pronounced at the point-of-sale for cash and checks and for consumer bill payments for giro and checks, but also differ to some degree for business and financial payments. In what follows, the primary institutional, legal, and cultural reasons for these observed differences in payment instrument use across countries are briefly outlined. Historical reasons for differences in the role of the central bank in these countries are also noted.

**The evolution of payments in Europe and the establishment of the giro.** Sixty percent of all non-cash payments in Europe take the form of credit transfer giro payments by individuals, businesses, and central and local government. As seen in Table 3, giro payments account for over 80% of all non-cash payments in Germany, the Netherlands, Sweden, and Switzerland; in 9 of the 11 European countries shown, giro transactions generate over half of non-cash payments. The remaining payments are divided between cards and checks and, in 6 of the 11 countries, the share of card-based transactions exceeds that for checks. Overall, only in 3 countries (the U.K., France, and Italy) do checks account for more than one-fifth of non-cash payments. Thus, overall, Europe has a giro-based non-cash payment system.

The historical reason for the dominance of credit transfer payments in most European countries is the early establishment of giro systems, to which postal savings organizations importantly contributed. This development has its roots in the banking structure and activities of European banks. In the early 1800s, banking in Europe was conducted by small banking houses (banker families) that did not accept public deposits to a significant extent. Indeed, the development of modern banking organizations that collected savings from the general public began in Europe around the mid 1800s when large, limited liability commercial banks were established in many countries. The resulting increase in deposit-taking activity led to the gradual increase of account transfer based payments at the expense of currency and coin. Other credit institutions, savings banks, credit cooperatives, as well as postal banks were established during this time and later around Europe. These institutions have since developed their activities to closely resemble those of commercial banks in continental Europe and Nordic countries. In Europe, the postal administration began to channel payments as postal payment orders during the 1800s. In addition, the postal system started to offer a major non-cash savings service (postal savings accounts) to the general public. Postal savings institutions of one form or another were established in all eleven European countries under study.

During the late 1800s and early 1900s, postal savings institutions, commercial and savings banks, and credit cooperatives set up their own separate giro-systems. In some countries, postal giro systems were developed first and only later did commercial banks and other institutions follow, in order to capture a share of consumer deposits by providing payment services. After a phase of competition between these separate systems, cooperative agreements between postal and bank giros were established in most European countries (Bank of Finland, 1993). The establishment of "wages to banks" systems in the late 1960s and early 1970s, where employers pay wages and salaries directly to employees' bank accounts, strongly increased the use of bank and postal account transfers as a
Table 3. Percentage shares of non-cash retail payment instruments: 1983-93 (all figures are percentages)

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Source: BIS: Payment Systems in the G-10 Countries, European Monetary Institute: Blue Book Addendum (1995), Bank of Finland and Finnish Bankers’ Association

Notes 1: The percent credit card payments are of all (debit and credit) card payments.
2: Direct debit figures for Norway, Switzerland, the U.S. and Canada are for 1992.
payment method in Europe. The existing giro infrastructure offered ready and safe solutions and captured the largest part of this growing payment volume.

**Giro payments moving to electronics.** The establishment of wages to banks systems (or direct deposit of payroll) was also an original impetus for electronic payment data transmission. Recurrent wage payments were originally initiated by sending magnetic tape data media to banks. Now, in most countries, the bulk of all payment orders are transmitted via telecommunication linkages. Business payments have moved rapidly to electronics, primarily through use of direct terminal links to banks, while giro payment orders from individuals are still often paper-based. This is slowly changing as home banking terminals are being installed and ATMs can increasingly handle account transfers and deposits in addition to cash withdrawals and balance inquiries.

The clearing systems for credit transfer giro payments started shifting to electronics in the early 1970s, in some countries even in the late 1960s. More recently, the popularity of electronic bill payments (through preauthorized direct debits) has significantly increased in many European countries. The share of direct debits in total non-cash payments (Table 3) has risen most in the most giro-oriented countries (Germany and the Netherlands) but also in traditionally check dominated countries (the U.K. and France). The direct debit system offers the payor an easy and safe way to effect recurrent (electricity, gas) utility, telephone, insurance, rent, and other payments on a specified due date. The one drawback of direct debits for consumers is that, because the payee initiates the payment (albeit at a specified time each month), the payor gives up control over when the bill is paid. But this loss of payor control is a benefit for the payee since cash flows are more certain with a direct debit than with a payor-initiated payment. Direct debits can also significantly reduce the amount of paper circulating in the payment system. Since electronic payments are usually less costly than are paper payments, resources will be more efficiently used.

23 Company terminals (computerized cash management systems) offer an interactive service via an on-line link to a bank's payment service system. For example in Finland the first terminals were introduced in the late 1970s. Currently, banks offer a wide range of sophisticated payment services on-line to their corporate customers.

24 Home banking is still in the very early stages of development, but has strong potential to increase in the future as it offers considerable convenience and control benefits for consumer bill payments. Current home banking services use either push-button telephones, videotext service (e.g., Teletal in France), or home computers to access a bank's computer and initiate a funds transfer.

25 In Italy this progress has been more delayed. In 1983 the members of the CIPA (Italian Interbank Convention for Automation Problems) started to progressively develop automated payment management techniques in order to reduce the volume of paper payment media.

26 Despite the historically large share of check transactions in France and the U.K., check truncation and electronic presentment of payment information is minor. Check truncation is one way in which the consumer could still use a check but the payment information it contains—the amount of the check, the payor and payee deposit and bank account numbers—would be read and captured at the bank where the check is first deposited and transmitted electronically to the paying institution. In France, only about 6% of checks are handled this way while in the U.K. truncation has yet to be introduced. In European countries with a historical reliance on giro payments, checks have never played a major role as a domestic payment instrument and efforts to modernize payment arrangements for ordinary checks have not been considered a worthwhile investment (CEPS, 1994).
The substitution of card payments for cash in Europe. Electronic POS card-based transactions with real-time linkages to account data represent a new stage in the evolution of payments in Europe and combine the finality advantage associated with currency use (legal tender) with the efficiency advantages of electronic account transfers. This is the case with on-line POS terminals that offer immediate settlement of transactions at the moment of exchange. These POS payments are close substitutes to currency in the sense that the party accepting payment takes no risk since funds are effectively transferred to the payee when the terminal is activated. On-line card-based payments thus enhance efficiency by reducing transaction costs, reduce the time interval before a payment order is credited to a payee's account, and limit the amount of paper in the payment system (Padoa-Schioppa, 1986).

In Europe, both the number of POS terminals accepting debit and/or credit cards and the number of transactions handled are, on a per person basis, greatest in Finland and France. Denmark, Norway, Belgium and the U.K. are also relatively advanced in this regard. Finland and France in particular demonstrate the power of cooperation between banks as a way to bring about a rapid diffusion of electronic payments. Cooperation in the establishment of infrastructure, the wide acceptability and compatibility of cards issued by different institutions, and the seemingly effective competition among institutions for customers has permitted the rapid diffusion of on-line card-based POS payments in France (Kearney, 1993) and Finland during the 1980s.

Reasons for giro dominance in Europe: banking concentration, nationwide networks, and cooperation. A concentrated banking industry and the nationwide branch networks of banks and postal savings institutions made it possible to establish giro payment systems in Europe based on credit transfers. Within the postal bank network, for example, it was only a relatively small step to bring in business accounts and offer first local, then regional, and finally nationwide bill payment services to savings account holders (Thomson, 1964). With centralized accounting, on a local, regional, and then a national basis, it was possible to determine whether a payor had sufficient savings in his giro account before a payment was made. As payments are rejected if funds in an account are insufficient, credit risk to the payee does not exist. Centralization of depositor account information made the shift from paper to electronic giro transactions in the 1960s and 1970s an internal issue, similar to that which has occurred within— but not between—banks in the U.S. during the same period. Compared to European countries, the U.S. is geographically many times larger, has a much more uncentralized and decentralized banking system, and has no nationwide postal payment service (other than little used postal money orders). In this environment checks have a clear advantage over credit transfers, at least before the recent development of low cost electronic communication technology.

Banking concentration has also played a major role in Europe by facilitating cooperation between banks and other institutions in the payment business. In a concentrated market, it is much easier to reach an agreement to establish a jointly owned giro system that, because of centralized clearing, is a lower cost alternative than use of geographically dispersed local clearing houses.

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27 Some POS systems do not operate on-line and allow the use of credit or deferred payment.

28 In Europe, restrictions on bank geographical dispersion within countries have been scarce (Gual and Neven, 1992) and antitrust policy has been more behavior-oriented, trying to detect cases where firms exploit their "dominant market position", rather than limiting market concentration itself (which has been the U.S. approach).
Cooperation among banks and other providers of payment services, actively coordinated by banking associations, first took place in Europe among giro organizations. Cooperation has since been extended to other payment systems and instruments, particularly ATM and card-based POS terminal systems. This has been relatively easy since other electronic instruments can take advantage of the network infrastructure already in place for electronic giro payments. This supply-side cooperation is an important factor in the swifter diffusion of electronic payments in Europe than in the U.S.

There are two primary reasons why cooperation encourages the installment of electronic payment technology (Vesala, 1993, Chapter 4.4). First, there are important scale economies in processing electronic payments. The fixed cost of setting up the necessary communication networks, links, and terminal systems represents the majority of the operating cost, leading to falling marginal and average cost as transaction volumes rise. As well, the addition of participants in electronic transfer systems (or, equivalently, clearinghouse arrangements) reduces both the average and marginal unit costs of processing payment transfers for the group as a whole. These network economies reduce transaction costs because it is less expensive to move funds between accounts within a single network than it is between networks.

Second, consumers prefer payment services that offer the greatest acceptability among retailers or have the greatest compatibility with the largest number of POS or ATM terminals. Wide acceptability and extensive compatibility provide greater user convenience and reduce user transaction costs. Hence, there exist significant positive network externalities in modern payment systems (Neven, 1993). By supporting joint networks, banks can meet this demand for compatibility and, also, small banks can continue to provide payment services for their depositors (provided that access to the network is fairly priced). Instead of proprietary payment systems, payment pricing and service quality issues form the parameters banks' increasingly use in competing with one another (Commission of the EC, 1992; Yamaguchi, 1993). Reinforcing this trend, the European Commission has established guidelines for cooperation and competition in the European Union.

The evolution of payments in Japan and the benefits of cash use. Japan, in contrast to Europe and especially the U.S., continues to rely heavily on cash at the point of sale. While some may view this as an indication of "insufficient evolution" of the Japanese payment system, it is more instructive to instead determine why Japan does not need to rely on non-cash payments as much as occurs in Europe or the U.S. In this regard, it is useful to review the advantages of cash over non-cash payment instruments, such as checks, bills of exchange, or promissory notes.

Payment costs can be further reduced when customers are induced to shift from paper to electronic giro payments. In some European countries, both bank and postal giro systems are currently: (a) reducing the proportion of their payment cost covered by float while raising the portion recouped through direct transaction fees; and (b) reducing the cross-subsidization among different payment instruments by making transaction fees of each instrument more closely resemble each instrument's average variable cost. These changes should shift demand toward lower cost electronic payments.

Cooperation is tolerated provided that it does not reduce market competition among institutions. In addition, there should be no attempt to block entry to shared payment systems or to protect participants from outside competition. Either event would be regarded as a violation of antitrust rules of the European Union (Commission of the EC, 1992).
There are at least three advantages to the use of cash. First, currency and coin represent final payment and thus are more readily accepted than many non-cash instruments which do not have this attribute. Non-cash instruments are provisional because they may not be paid when presented (due to insufficient funds in a payor's account for a check, refusal to pay a bill of exchange, or default by the maker of a promissory note). Thus the creditworthyness of the payor needs to be determined when payment is offered using a non-cash instrument while this credit risk does not exist with cash. Second, cash can be immediately reused while collection of non-cash instruments is often delayed when drawn on non-local payor institutions. Third, cash is divisible and can be used to complete other transactions of differing amounts while checks or bills of exchange (when signed over to another receiver) are only poorly adapted for transactions of a differing amount.

Under certain circumstances, the use of cash can be a disadvantage. First, cash is a disadvantage when the amount needed for a payment is very large. Second, cash is not a convenient payment instrument when payment is required at a substantial distance from the payor, which could be across town or in a different city rather than nearby. Third, and perhaps most important, holding a large idle balance for cash payments can, in countries with a relatively high crime rate, increase the risk of loss and/or personal safety to unacceptable levels. Finally, when interest rates are high, the opportunity cost of cash compared to deposit money is high in terms of interest foregone on idle cash holdings.

Considering these advantages and disadvantages, cash payments would be preferred over non-cash instruments for essentially local transactions where the values involved are not overly large and the crime rate is low. Indeed, if there was little risk of theft or loss, there would be little need to use non-cash instruments at the point-of-sale because the disadvantages of cash use—large values, distance, and loss—would be minimal while the advantages—payment finality, timeliness, and divisibility—would dominate. Conversely, when the disadvantages to cash use loom large, non-cash instruments will be favored. In Japan, this occurs today for bill payments (inconvenient distance) as well as business disbursements and financial payments (large values and inconvenient distance). In other countries, particularly the U.S., a higher crime rate is an incentive to replace all but the lowest value cash transactions with non-cash instruments.

Three stages in the evolution of Japanese payments. The evolution of the Japanese payment system has undergone at least three major events. First, with the Meiji Restoration in 1868, there was a strong, coordinated effort by business and government to establish a more modern banking system.

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31 In addition, cash does not leave a paper trail, making it more difficult to keep accurate, verifiable records. Although this is a cost for some, particularly for legal business transactions, it is a benefit for others who wish privacy. While the use of cash has an opportunity cost which is typically a function of the interest rate, this cost needs to be compared with the prices of non-cash instruments faced by users to determine what the relative price incentives may be regarding payment instrument use.

32 Japan is a relatively safe country and this permits cash to be heavily used in transactions at the point of sale (Federation of Bankers Associations of Japan, 1994a, p.95 and 1994b, p.1).

33 Statistical analysis indicates that a higher incidence of violent crime is positively and significantly associated with the increased use of non-cash payment instruments across the 14 developed countries covered in this paper (Humphrey, Pulley, and Vesala, 1996).
The number of banks and clearing houses was expanded, a central bank was established, and new financial markets were developed. Over 150 national banks, dispersed nationwide, were established by 1878. Initially, these banks were able to issue private bank notes or currency which began to replace coin in transactions. As it turned out, the expansion of private bank notes was too rapid and led to inflation. This problem was addressed by the establishment of a central bank which, by law, became the sole issuer of currency so the growth of the money supply could be better controlled. With this development, private national banks were forced to change from note-issuing institutions into deposit banks, leading to an expanded use of paper drafts (checks) for business transactions. This was facilitated by the growing custom of paying checks, bills of exchange, and other promissory paper instruments within a due date, rather than—as with inter-enterprise book credit arrangements within business (keiretsu) groups—leaving the payment date vague or unspecified.

Although local clearing houses existed for paper drafts (checks and bills of exchange) in major trading centers prior to the establishment of the Bank of Japan (BOJ), their expansion was facilitated by the opening of regional offices of the BOJ and the ability to settle clearing house net debits using BOJ accounts. This permitted trade to expand, both absolutely and geographically. A national postal system was established in 1881 and, in addition to providing for the faster movement of paper drafts between cities and trading centers, it also offered a postal money order service for consumer payments. However, the government limited postal money orders to low values so as to encourage a bank check/draft system. As a result, postal money orders were used primarily for local bill payments while checks and bills of exchange were used for larger value business payments both locally and between trading centers. More flexibility in terms of payment values was obtained later with the establishment of a postal giro in 1906. At present, the postal service—which is exempt from corporate income tax—operates a nationwide giro system with 24,000 offices, versus 15,000 for banks. The postal giro provides the same payment services for consumers as do banks and includes access to cash through offices and ATMs, paper-based and electronic bill payments (direct debits) and electronic deposit of payroll (direct deposit).

A second major event in the evolution of the Japanese payment system occurred in 1943 with the establishment of the National Centralized Domestic Exchange Settlement System (NCDE) operated (at least initially) by the central bank. Previously, reciprocal holdings of interbank correspondent accounts had been used to clear non-cash payments between banks and among clearing houses in different cities and trading centers. When the number of banks is very small, clearing through correspondent balances is workable and reasonably efficient (Tsurumi, 1994b). As more banks are added, however, this process becomes quite cumbersome and inefficient since the number of balances to be held and maintained grows much faster than the number of banks. Even though the number of commercial banks in Japan fell from 1,800 in 1922 (prior to the Great Depression) to only 78 in 1944, a centralized clearing arrangement was still preferred to one based on reciprocal correspondent

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34 The Bank of Japan, during the 1890s, offered both clearing and settlement services in an attempt to gain more control over the financial system. This was successful in a few large cities but, at the turn of the century, the BOJ reversed course. It withdrew from clearing paper drafts in competition with clearing houses but still provided settlement. For more detail, see Tsurumi (1991 and 1994a).

35 If all correspondent banks held reciprocal clearing balances with each other, then for n banks there would be n(n-1) balances (which rises faster than the change in n).
balances. Pressure to adopt centralized clearing resulted from a desire to conserve increasingly scarce labor and materials resources in a wartime economy. This pressure also forced the central bank to operate the NCDE system but, once the war was over, operation was shifted to the banks themselves with the central bank only providing settlement.

As a clearing entity, the NCDE was a compromise between a credit and a debit transfer system. The clearing rule adopted was that a payor's bank had to have deposited the amount to be paid in its central bank settlement account—but not necessarily to have transferred these funds to the payee bank's settlement account—before the payee's bank would be able to provide funds to the payee. In a credit transfer arrangement, the transfer between bank settlement accounts would have occurred before funds could be released to the payee (eliminating systemic risk). In a debit transfer system, the payee could receive funds from the payee bank before the payor's bank had even funded its settlement account, much less transferred funds to the payee bank's settlement account (creating systemic risk). The NCDE clearing rule (when followed) does not create systemic risk as long as the funds deposited in the payor's settlement account can not be removed (or attached by some other creditor in the event the payor fails) prior to settlement of the transaction. If these conditions are met, then the NCDE clearing arrangement is similar to a fully collateralized net debit and would not create systemic risk.

The third element in the evolution of Japanese payments was the development of a nationwide, privately operated, electronic payment system (Zengin) in 1973. The Zengin system currently connects 3,778 financial institutions (commercial banks, specialized banks, credit unions, and mutual funds) and their 45,000 branches. The purpose was to replace the paper-based NCDE system with a more efficient electronic system. This was made possible in part by the fact that Japan is a small country so the communication costs (laying cable, etc.) were relatively inexpensive. The bank-operated Zengin system processes only about 26% more payments than does the postal giro. Both networks primarily process consumer bill payments and payroll, pension, and dividend deposits. The Zengin market share of these payments is 56% with 44% for the postal service.

Electronic payments were expanded further in 1988 with BOJ-NET, a nationwide large value wire transfer network for 386 depository institutions and security firms owned and operated by the Bank of Japan. More recently, the use of checks and bills of exchange—traditionally used for business payments—has decreased due to a stamp tax on bills of exchange and the availability of a new bank electronic payment arrangement—a package transfer—where an enterprise automatically pays all of its suppliers on a fixed day each month (Federation of Bankers Associations of Japan, 1994b, p.3).

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36 Of the 78 banks in 1944, 5 were large "city" banks with a nationwide branch network while 73 were local banks with a limited branch network.

37 Around 70% of all recurring electricity, gas, water, telephone, and a TV bills are made by direct debit through the postal giro or the Zengin system. Electronic payments of credit card bills, taxes, and rent are also common.

38 The Zengin system is backed by pledged collateral determined as a fixed percent of a participant's self-selected net debit cap. A loss-sharing rule has been adopted in the event this collateral is insufficient to cover a participant's failure (BIS, 1993, p. 277).
Finally, an electronic delivery-against-payment system for government bond trading started operation in 1994.

The evolution of payments in the U.S. and the reason for check use. The U.S. is a check-intensive country. The evolution from cash to checks is largely due to two historical facts, both of which are unique to the U.S. First, from its inception, the U.S. banking system provided savings and safekeeping services to the general public. Thus, unlike Europe where banks served only the merchants and the wealthy, there was no savings or transaction service vacuum for the postal service to fill. As a result, a postal giro was never established.

Second, the U.S. is a geographically large country and the banking system, although starting out as a national monopoly (e.g., the First and Second National Banks of the U.S.), has been very unconcentrated for the last 150 years. Until quite recently, banks were only permitted to operate within a single state and, in many states, to only have a single office regardless of whether they were state or federally chartered. Only after the Great Depression were state laws slowly liberalized to allow a bank to branch within a state. Consequently, both consumers and businesses were restricted (for legal and convenience reasons) to hold their funds at different local or regional banks and account information was never centralized. When payors and payees have accounts at different and geographically dispersed banks, the only cost-effective way to make a non-cash payment—prior to the development of low-cost electronic communication—was to use a check or some other paper draft. Thus intensive check use was the logical and, at that time, cost-effective outcome of limiting the concentration of the banking system in a geographically large country.

At some point after 1997, when U.S. banks are allowed to branch nationwide and when POS terminals become more available than they are at present, the U.S. will start to become more like Europe and Japan and increasingly use a final payment method to replace provisional check payments. However, for reasons noted below, the replacement of checks by electronic payments will be slow.

Stages in the evolution of U.S. payments. With the expansion of domestic trade and the rise of population density in trading centers during the early 1800s, paper checks increasingly substituted for currency in business transactions. This represented the first stage in the evolution from currency to the use of non-cash payment instruments. By 1865, bank deposits had exceeded the value of currency in circulation and checks played an increasingly important role in the U.S. payment system. The passage of the National Bank Act expanded the number of national banks and imposed a 10% tax on bank notes issued by any institution other than a national bank. The tax soon eliminated the use of bank notes issued by state chartered banks and reduced the supply of currency for transactions. This vacuum was filled by deposit money in the form of increased use of checks for trade and exchange, in turn made more available by the expansion of deposits in national banks (Spahr, 1926, pp. 84 and 161).

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39 Government securities are traded in this manner, using a book-entry system, over Fedwire in the U.S.

40 A debit card which activates a real-time payor account balance inquiry is, in effect, equivalent to a giro point-of-sale transaction, since both are electronic credit transfers.
The rise in the use of deposit money was also accompanied by a series of banking panics, leading to major financial crises. These recurring panics typically started with the insolvency of a few banks and quickly spread to solvent but illiquid institutions as well. The deposit runs and bank failures that followed led to contractions of the money supply, reductions in bank credit, and economic depressions. These panics also reduced the acceptability of checks in trade due to the uncertainty of being able to collect funds when a check was presented for payment. The occurrences of bank illiquidity were, in the breach, met by the issuance of clearing house loan certificates which were used to satisfy interbank net debit positions, and technically represented the untaxed (and therefore illegal) issuance of private, non-bank currency (Roberds, 1995). These recurring bank liquidity problems were finally addressed with the establishment in 1913 of a central bank that had the sole power to issue currency, expand the money supply, and thus create needed liquidity through the discount window. While this mitigated the illiquidity problems from bank deposit runs, the establishment of a system of deposit insurance in 1934 finally provided the necessary confidence to prevent deposit runs to begin with, rather than provide liquidity through a central bank loan after a run would occur.

The settlement of checks among banks both locally and interregionally occurred with the exchange of interbank correspondent balances among institutions. Correspondent balances were established and maintained through the shipment of gold, and later currency, between banks. Shipping costs were basically proportional to the value of the currency or gold being shipped. Out of this process evolved a system of check exchange charges that were proportional to the par or face value of the checks being exchanged. Unfortunately, the system of check exchange charges was not uniform and this led to circuitous routing of checks for collection which delayed their collection and hindered commerce (an issue discussed in more detail below).

The establishment of the Federal Reserve represented a second stage in the evolution of the U.S. payment system and altered it in two important respects. First, Federal Reserve member banks (typically, the largest banks) could transfer local and interregional settlement funds by wire using a single reserve-account balance held with an office of the central bank. This reduced the need to hold and maintain a complex network of correspondent balances—and the physical shipment of gold or currency—to settle check payments. The second change to the payment system was the elimination of non-par banking (discussed below). This greatly improved the efficiency of checks in the payment system but required the direct intervention of the central bank in the processing of these instruments in competition with correspondent banks and clearing houses, a competition which still exists today.

A final stage in the evolution of the U.S. payment system, similar to that in Europe and Japan, is the movement from paper-based to electronic payments. This has occurred on two fronts during the 1970s: credit card payments processed by the private sector and a Federal Reserve effort to develop an electronic substitute for the check. The switch from processing paper credit card drafts to making these payments electronic has been markedly more successful than the effort to switch from checks to automated clearing house (ACH) electronic payments. Credit card payments currently account for over 16% of total U.S. non-cash payment volume while the ACH (which handles some giro-type credit transfer payments) accounts for less than 2%. Credit card transactions have been more successful because they meet better consumer convenience needs.

Serious barriers exist for the rapid expansion of electronic payments in the U.S. These concern the existence of substantial check float, the way payment services are priced, bank sunk costs in check
processing operations, and the unconcentrated nature of the banking system along with strong antitrust laws. Unlike Canada, which also is a heavy user of checks, check users in the U.S. have a float incentive to use checks. Businesses enjoy about 90% of the float benefits associated with checks despite writing only about 40% of the total volume (Humphrey and Berger, 1990). Overall, from the check user's point of view, a check is cheaper to use than an electronic payment, even though in terms of social or real resource cost a check can be more expensive than an electronic payment.

A second barrier to the use of electronic payments is the lack of cost-based pricing incentives to users of payment instruments. This stems from a Depression era law forbidding payment of interest on demand deposits. Prior to the 1980s, banks generally provided check services to depositors at no charge in order to compensate depositors for their inability to pay interest on transaction accounts. This "barter" arrangement was changed in the early 1980s with legislation permitting the payment of interest on new consumer transaction accounts, but not on demand deposits. As consumers shifted to the new interest-earning checking accounts, banks attempted to recoup the interest paid on these deposits through minimum balance requirements and monthly fees. As these user costs were not related to the per transaction use of checks, consumers "see" a zero price for each check they use and view check float as a private benefit.

Another barrier to electronic payments is banks' sunk cost in existing check operations. Although new electronic payment technology has a high proportion of fixed to variable cost, check processing and delivery also has a fixed cost. Importantly, the fixed cost associated with checks has largely been paid for. Thus, from the bank's point of view, it is not profitable to adopt a new payment technology unless its expected average total cost per transaction is less than the average variable cost of checks. Sunk costs make it hard to change payment arrangements at the supplier level because any new technology not only must have a lower average cost per transaction, but also a cost sufficiently lower to offset the sunk cost in the current system. Even so, if banks did try to switch users from checks to electronic payments, they would merely cannibalize their check service and not realize any important gain in payment market share. As depository institutions have monopoly access to central bank settlement services, the only real competition that exists is within the banking industry and the existence of sunk costs inhibits change.

Lastly, the banking system is very unconcentrated and the U.S. has strong antitrust laws. With 10,800 banks, 2,400 savings institutions, and over 12,000 credit unions, it would be difficult to obtain agreement to provide a nationwide paper or electronic payment service similar to the giro in Europe or the Zengin system in Japan. The problem with establishing such a bank-owned facility is that it would require the participation and agreement of hundreds of large banks in order to operate effectively nationwide. And, if such a payment facility proved successful, non-participating institutions could argue—under existing antitrust law—that they too should be allowed access as the facility is "essential"

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41 In Canada, business payors are charged for the check float they create. Because float is costly to payors, there is a strong inducement to disburse checks close to where payees are located to minimize check collection times. By agreement among banks, payees who deposit checks are given immediate availability to their funds (rather than having to wait until a check is collected).

42 Average variable cost, rather than average total cost, applies for checks because check fixed costs have already been largely recovered and the existing investment still has considerable economic value.
for their business (McAndrews, 1995). Thus, the institutions that developed the facility could not realize all of the potential externalities of their investment and market share improvement. For these reasons, U.S. banks are unlikely to jointly develop a new nationwide electronic payment network for consumer and business payments. A more likely outcome would be that banks adapt the existing credit card and debit card networks for this purpose over time.

The historical role of the central bank in the payment system. The principal roles of developed country central banks in the payment system today are to (1) provide settlement for the full range of payment transactions and (2) supervise and, in many cases, also operate a large value domestic wire transfer network. While there have been instances in the past when central banks have, for short periods of time, provided processing services for other types of payments, only the U.S. central bank continues to do so. Although accurate in broad terms, this generalization glosses over important differences within Europe regarding central bank involvement in clearing and settlement arrangements. In countries where the central bank has full responsibility for monetary policy, there has been a tendency for the central bank to exercise significant control over the operation and design of domestic payment systems. At one end of the spectrum, the central banks of Germany and France facilitate the transmission of retail payments and the associated payment information between banks in addition to large value payments which makes their role in the payment system quite central. Central bank involvement in payment systems has also included, in many cases, the promotion of standardization and cooperation among payment participants in order to minimize the social cost of supplying payment services. At the other end of the spectrum, the Bank of England does not have any statutory powers over the U.K. payment system and the system is almost solely dependent on the private sector; CHAPS and Town Clearing, for example, are run by a private organization (APACS, the Association for Payment Clearing Services) of which the Bank of England is a member.

Typically, the provision of central bank payment processing services has been related to a breakdown in the capacity of the private sector to safely or efficiently provide these processing services for itself. A case in point is central bank provision of a large value wire transfer service. In this case, the central bank is a neutral party to transactions among banks, has the ability to create money and grant credit, and thus is the desired entity to provide for the transfer and simultaneous settlement of large value funds and security transactions. Often this is facilitated by the ability to use idle balances held for purposes of monetary control for the secondary task of clearing payments. This reduces the need to hold payment clearing balances elsewhere, such as with correspondent banks. In developed economies, the huge number of financial transactions and large interbank obligations demand timely same-day final settlement of payments to reduce intertemporal risk and facilitate trade. In such an environment, it is much more efficient to have a centralized settlement facility rather than settle through numerous interbank correspondent (or nostro) accounts, each of which would require sufficient balances to meet settlement obligations (Blommenstein and Summers, 1994). Thus a two-tiered interbank payment system is, at a minimum, desired: tier 1 would consist of the central bank’s settlement facility while tier 2 would be composed of commercial banks. In countries where there happen to be large numbers of small financial institutions which also provide payment services, a third tier often arises where some of the larger banks act as clearing agents for this set of institutions. Such arrangements are in place in the U.K. and Germany (as well as the U.S.). While there are strong reasons for central bank involvement in large value payments, the justification for also being involved in the processing of other types of payments is less compelling. The U.S. experience, outlined below, illustrates the best known case for central bank intervention in this regard.
The U.S. central bank started out providing free check processing services to banks that were members of the Federal Reserve when it was established in 1913. Member banks held idle reserve balances with the central bank for the dual purpose of settling payment transactions and for monetary control (through the deposit multiplier). The main purpose for having the central bank also provide a check processing service was to eliminate the private bank and clearing house practice of non-par checking. Non-par checking was where checks deposited by customers were paid, not at face value or at par, but at a discount from par. This discount from par was how collecting banks covered their costs of collecting a check. However, the discount varied across banks according to their favorable geographical placement in the collection chain (higher discount) as well as their desire to attract correspondent deposits associated with clearing checks (low or zero discount). In order to minimize collection charges, collecting banks would attempt to route checks through those correspondent banks with the lowest collection fees, even though this often was not the shortest distance to the paying bank on which the check was drawn. This led to circuitous routing of checks, increased payment float, and thereby inhibited commerce (Spahr, 1926).

The central bank was given the legal authority to collect checks for its member banks at par and, since this minimized collection and float costs, more and more checks came to be processed and collected through the Federal Reserve. To remain competitive in the check collection business, correspondent banks also insisted on being paid at par, threatening to otherwise collect items through the central bank. Finally, non-par banking was eliminated regardless of who—the central bank or a private bank—was the collection agent.

Prior to the pricing of Federal Reserve payment services in the early 1980s, the central bank's share of the check processing market was around 33%. After pricing, the Federal Reserve's share fell to around 25%. The remaining shares are comprised of on-us items (30%) plus correspondent banks and local check clearing houses (45%). With the advent of interstate bank branching in 1997, U.S. banks will become larger and their offices more geographically dispersed. This will increase the proportion of on-us checks and further reduce the check processing market share of the Federal Reserve.

In the long-run, the Federal Reserve will increasingly become the check processor of "last resort"; it will be used by only small banks for the purpose of offsetting the market power of large correspondent banks. As its market share dwindles, due to the growth of on-us checks, reciprocal

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43 One widely quoted example of circuitous routing at the time concerned a check deposited at a bank in Hoboken, New Jersey, and drawn on a bank only 100 miles away in Sag Harbor, New York. This check "...passed through eleven banks, traveled about 1,500 miles, and was in transit about eleven days..." (Spahr, 1926, p. 105). Almost every businessman, the primary user of checks at the time, had a similar horror story to tell about their ability to collect checks in a timely fashion.

44 On-us checks are those that are deposited at the same bank they are drawn on and so are processed internally.

45 The last survey of U.S. checks was for 1979, before Federal Reserve payment services were priced. Thus these market share figures are estimates.

46 With the full implementation of nationwide banking and branching, the central bank's check processing market share may fall to 13% to 18% (Berger and Humphrey, 1988).
electronic presentment among large banks and check clearing house associations, plus the replacement of checks by credit card, debit card, and ACH payments, the central bank will likely at some point exit the check processing business. The issue then will be whether the central bank should also turn over its ACH processing business to the banking associations which use it. Currently, the Federal Reserve's market share of ACH processing is around 90%. However, since the volume of ACH transactions is only 2.5% of the over 60 billion checks processed each year, the effect of such a transfer would be less than that of exiting the check processing market.

As outlined, the role of the U.S. central bank in check processing is seen to result from a historical failure of the private sector to provide an efficient, low float, processing environment for the smooth flow of commerce. This failure was largely due to the highly unconcentrated nature of the banking system brought about, in turn, by restrictive laws which limited branching—and thus bank size—in a country that was geographically quite large.

Had the U.S. not restricted bank size and their geographical distribution, it is then likely that non-par checking would not have had the disruptive effects on commerce that it did. Instead of thousands of tiny, one-office banks, there would have been only hundreds of much larger sized banks with geographically dispersed offices—similar to what occurred in Canada. As a result, many more checks would have been cleared as on-us items (so only one remittance fee would be charged to collect a check) and non-on-us or transit items would have had to go through far fewer correspondent banks to be finally paid. Had these conditions existed, then the discount from par to collect a check would have been less and the incidence of circuitous routing—with its accompanying float cost—would have been considerably reduced. If the disruptive effects of non-par checking on commerce had been mitigated in this manner, it is certainly less likely that there would have been a need for the Federal Reserve to provide a check processing service, and the political justification for such action would have been markedly reduced.

Overall, if the private sector is unable or unwilling to provide an environment in which payments can be made in a timely fashion, then it may be necessary for the central bank to (a) intervene indirectly by supporting changes in payments laws or other incentives or (b) intervene directly by taking an active role in payment processing activities themselves to alter the situation (as occurred in the U.S.).

VII. Lessons for emerging market economies

Payment systems involve the point-to-point transfer, processing, and settlement of payment information between payors and payees (and/or their agents). Our economic and historical analysis of payment system evolution in developed countries has focused on what is effectively a constrained cost

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47 Like the U.S., Canada had a system of check exchange charges—leading to non-par checking—but these charges were uniform (Spahr, 1926, p. 32). While exchange charges would tend to limit the growth of checks as a replacement for cash, particularly for retail and some business transactions, their uniformity would not have led to the circuitous routing and float cost experienced in the U.S. In addition, Canadian banks were relatively larger (so more checks were on-us) and nationwide branching was permitted (reducing the need to use other banks to collect checks outside of the local area).
minimization problem for transferring payment information and we have noted how this process has been molded by country-specific geographical, institutional, legal, communication, cultural, and economic constraints.

The evolution of the payment systems of Europe, Japan, and the U.S. provide some lessons for how emerging market economies may cost-effectively direct and facilitate the development of their own payment systems. Similarly, the role played by developed country central banks in this process suggests a guideline for the proper role of other central banks. As illustrated above, the evolution of a country's payment system is largely determined by the following country attributes and conditions:

(i) Country size and population density;
(ii) Banking system concentration and interconnectedness;
(iii) Payment instrument legal structure and antitrust laws;
(iv) Crime rates and other cultural factors; and
(v) Risk and efficiency tradeoffs for different transactions and payment instruments (relative payment costs versus user requirements and needs).

By assessing the extent to which each of these five conditions may apply to a particular country, it is possible to obtain a good idea of the likely cost-effective evolutionary path of a payment system.

**Country characteristics and the adoption of specific payment arrangements.** As suggested in the beginning, a useful way to view a country's payment system is in terms of separate yet broadly similar types of transactions associated with payments at the point of sale, the payment of bills and other recurring payments away from the point of sale, disbursements for wage and payroll payments, and all types of financial market transactions. In each of these categories, payors and payees face different cost and convenience incentives that are associated with the size of the country, the concentration and centralization of the banking system, the underlying legal structure, crime rates, and various risk, transaction cost, and user convenience considerations. From our analysis, the following conclusions are drawn regarding cost-effective payment instrument use for an emerging market economy.

**Point-of-sale payments.** POS payments are best handled by cash if a country's crime rate is low, as evidenced by the experience of Japan. Cash payments are final, are immediate, and can be reused for other transactions of a different value. Cash also creates seignorage revenues for the government (as its production cost is less than its face value). However, if the crime rate is high, the banking system is unconcentrated, and electronic communication within and among banks is expensive (due to large geographical size of the country), then a check will probably be the preferred alternative, as is the case in the U.S. If the crime rate is high but the banking system is concentrated and an efficient electronic communication infrastructure exists (because the country is small and/or densely populated), then a credit card or debit card system can be a lower cost alternative than cash and/or checks would be over time. These generalizations, of course, will be affected by the existence (or the lack of) a proper and enforceable legal foundation dealing with the rights and liabilities of users of non-cash payment instruments (whether paper-based or electronic).
**Bill payments.** Bill payments in cash are inconvenient because cash usually involves a face-to-face transaction. Even when the crime rate is low, non-cash alternatives are preferred to cash (as seen in Japan). If the crime rate is high and the postal service is reasonably efficient, mailing a check becomes the preferred alternative to cash if the banking system is unconcentrated and no centralized payment facility exists (as in the U.S.). If the banking system is concentrated and/or a centralized payment facility exists, paper-based giro payments are likely a lower cost and more convenient alternative than cash or checks for bill payments. And if the internal accounting system of the centralized facility can be made electronic, then electronic giro payments will be cheaper than paper-based payments when the country is not large (which is the experience in Europe).

**Disbursements.** When the crime rate is low, then disbursements in cash (payroll payments, person-to-person payments) have been commonly used. When the crime rate is high and the banking system is unconcentrated, then disbursement by check is safer and cost effective as well, although it may also mean that workers will take time off from work to deposit/cash their check when paid. When a central payment facility exists, disbursements can be made directly to the employee's account using either paper-based or electronic payments (depending on cost).

**Financial market transactions.** Financial market transactions are typically of very large value and require secure and timely transfers. The best alternative, due to its safety, speed, and connection to the banking system, is a wire transfer network within and between major money centers in a country. All developed countries have such networks and/or have access to them. In this instance, the real choice is between a low volume telegraphic communication system, a high volume dedicated wire network, or a series of specialized and centralized paper or electronic book-entry systems for different financial instruments (or some combination of these different approaches).

It is seen that there is not just one path for a payment system to follow but many, and the choice depends on the specific situation in a country regarding the five constraining factors listed above. Overall, the historical evolution of payments in Europe and the U.S. is arguably more relevant for emerging market economies that do not yet have a relatively developed electronic communication infrastructure so paper-based payments will have to be relied upon for many business and financial transactions. Economies with a developed communication infrastructure will likely find it cost-effective to move more rapidly to electronic payments and, while passing through a period of paper instrument use, will not concentrate as heavily on these instruments as have the developed countries. In terms of development priority, problems with business and financial market payments should be addressed before important improvements are considered for point-of-sale and bill payments. However, reforms should not stop here. Improvements in the efficiency and convenience of retail point-of-sale and bill payments in a manner that meets users' preferences can greatly facilitate trade and exchange for the majority of the population, evidence of which exists from the evolution of payments in developed economies. Toward this end, a range of different payment instruments should be made available since no one instrument is best suited for all kinds of transactions nor meets all consumer needs. Such a multiplicity of payment instruments, of course, needs to be balanced with reforms to restructure a payment system in a cost efficient manner.

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48 Speedy processing of paper-based payments requires the standardization of payment information and its placement on payment instruments so it can be read electronically. Similarly, common formats are a precondition for efficient electronic payments.
Evolving payment arrangements in emerging market economies. At the moment, many developing countries use cash for most POS and bill payment transactions. Enterprises, in contrast, rely on check or other paper-based payments as their payments are typically for larger values and are relatively few in number. Electronic payments, when they are being developed, are initially (and properly) focused on providing for more timely large value inter-enterprise and government payments. This general description fits China, India, Thailand, Indonesia, the Philippines, Columbia, Mexico, as well as other developing countries. This description also fits the many countries in transition from a command economy with a monobank financial structure to a more market-based structure. Formerly centrally planned economies, however, do not have the necessary legal, accounting, and regulatory framework needed to implement successfully payment system reforms, and so face many more barriers in their attempt to improve their payment system (Sato and Humphrey, 1995).

The countries in transition, for example Russia and other East-European ex-socialist countries, have relatively developed deposit money based systems but the bulk of consumer and even many business payments are still made with cash (Commission of the EC, 1995). The common problem is that the payment system is unreliable and slow; bank transfers can take weeks in some countries and therefore it is often bypassed with many transactions carried out using cash. The need for intervention in payment systems through well-defined reform programs has thus been clear in most cases.

In an attempt to shift inter-enterprise payments away from cash, and to enforce monetary control as well as to support the ruble (instead of western currencies) in domestic transactions, the Russian government has stipulated that certain important Russian enterprises denominate their payments in rubles and transfer funds using bank transfers. No cash payments are allowed and deviations require the permission of the central bank (Salonen, 1995). What effect this ruling will have in practice remains to be seen but it illustrates the strong intention of the state to influence payment practices.

In the early 1990s, the Russian payment system was in dire condition and it took weeks for funds to be finally transferred to payees. In the hyperinflationary conditions that existed, this was quite detrimental and encouraged the outflow of capital from Russia. At that time, non-cash payments could only be cleared through existing central bank offices which were not set up to process payment orders in a timely manner. After direct account relations in rubles between a few Russian banks were permitted in 1992, a number of banks have set up a competitive correspondent-based payment clearing network (Salonen, 1995). While this resulted in a substantial improvement in the payment situation, it also demonstrates how fundamental changes in legislation are often needed before any progress can be achieved. However, no centralized or multilateral clearing operations are yet in place and the current system is based entirely on bilateral relations. A week can still be easily lost in Russia when transferring funds. The great size of the country, the differing stages of development in the various regions, and the use of heterogeneous payment technologies make it difficult to implement a comprehensive payment development plan in Russia. For these reasons it is difficult to forecast the shape of the "final" payment system in Russia. The banking system has also developed very swiftly but in an unpredictable manner. The number of commercial banks increased enormously during the 3 to 4 years after Perestroika largely because the threshold for establishing a bank was deliberately set very low in order to rapidly develop a private banking sector (Laurila, 1995).
In many respects the development of the financial sector has been even swifter in Eastern Europe, where fewer obstacles were faced in shifting the earlier command economy toward a market-based system (Commission of the EC, 1995). Market-based reforms seem to be working reasonably well in these countries and are facilitating banking and financial sector development. Two different approaches to reform seem to have generally been pursued: either a gradual conversion of the old state banking system (as in Hungary, Poland, and the Czech Republic) or a more radical transformation which has created a new banking and payment system (as in Estonia and Russia). The future will determine which of these two approaches has proved to be the more successful. Still, a lot remains to be accomplished before payment system efficiency and reliability reaches international standards.

An issue which has plagued all Eastern European transition economies, and has had significant economic consequences, is the growth of payment arrears by enterprises, banks, and even the government. Payment arrears have, for example, increased credit risks in the economy and made emerging banks even more fragile. Payment arrears have not stabilized in Russia even though they have stabilized elsewhere in Eastern Europe (Hirvensalo, 1995; Bank of Finland, 1995). At the outset, the arrears problem in Russia, Romania, the Czech Republic, and Poland was associated with the malfunctioning of the payment system. However, in Russia, the problem has persisted as enterprises continue to expect financial aid from the government and government initiatives to impose budgetary discipline have not been credible. As a result, many unprofitable enterprises have kept on operating as effective bankruptcy procedures are not in place and there is a lack of financial discipline in the system. Improving the payment system could alleviate the arrears problem to some extent, although the primary solution lies reducing the number of unprofitable enterprises.

The problems facing other developing countries in reforming their payment systems are less daunting and primarily revolve around (a) obtaining the funds necessary to upgrade the operation of their current paper-based system by improving intra-bank payments between branches of the same bank and (b) establishing an electronic large value payment network between major banks within and between the primary trading centers of the country. This is one area where geographic size plays a very important role: Thailand and Viet Nam, for example, are finding it much easier to implement an electronic real time gross settlement (RTGS) large value payment network than is the case for China, the Philippines, and Indonesia which are considerably larger countries with more trading centers and a more dispersed system of bank branches (World Bank, 1995).

The role of the central bank in the payment system. The overall relationship between a country's central bank and economic and financial development is quite broad in practice. Central banks must consider the linkages between the efficient operation of a country's payment system, the level of reserve or clearing balances needed to contain payment risks, and the liquidity needs of the system under different settlement arrangements. These payment system issues are, in turn, linked with bank soundness regulations and safety net arrangements—a lender of last resort bank liquidity facility and possible deposit insurance or guarantees.

More narrowly, the principal roles of central banks in the payment system focused on in this paper have been: (1) providing settlement for the full range of consumer, business, and financial payment transactions; and (2) supervising and/or operating a large value domestic wire transfer network. Central banks are explicitly in charge of the systemic stability of the payment system in many countries. In addition, central banks have served to promote payment system reform and facilitate
cooperation among banks to improve payment arrangements, fostered policies where banking services are priced close to their actual costs, and worked to reduce interest and exchange rate controls which tend to distort resource allocation and trading structure. Of equal importance, due to the fragility of a highly leveraged banking system, is the need for central bank oversight and/or direct responsibility for maintaining bank soundness. This is achieved through regulatory channels and safety net arrangements which protect both the banking system and the operation of the payment system. Banking system stability enables payment system users to develop and maintain confidence in lower cost, bank-related payment instruments and so improves payment and economic efficiency by lowering transactions costs.

While there have been instances in the past when central banks have, for short periods of time, provided processing services for other types of payments (e.g., Japan during the 1940s), the U.S. central bank continues to play a major role here. However, there are instances in various emerging market economies (e.g., the Philippines) where the central bank provides for the processing and clearing of inter-regional paper-based payments, while the private sector handles local payments. This should be viewed as a forerunner of a central bank operated or supervised large value payment network rather than the central bank replacing the private sector in processing low value payments (as occurs in the U.S.).

Settlement through a central bank is a lower cost and safer procedure than having the private sector perform this task. Similarly, having the central bank also provide payment processing services has typically been related to a breakdown in the capacity of the private sector to safely or efficiently provide these processing services for itself. A case in point is central bank provision of a large value wire transfer service, which is directly related to the safety of having a neutral party with the ability to create money (liquidity) also provide for the transfer and simultaneous settlement of funds and security transfers of exceptionally high value. Often this is facilitated by the ability to use idle balances, held for purposes of monetary control, for the secondary task of clearing payments. This reduces the need

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49 Cooperation among banks enabled Europe and Japan to establish a cost-effective nationwide electronic payment network for relatively low value bill payments and POS transactions. Cooperation to shift to lower social cost electronic payments is markedly more difficult once checks become an established payment instrument. The float benefits accruing to check users (as in the U.S.) or the banks (as in emerging market economies) provide a strong incentive working against change.

50 Cost-based pricing of bank and central bank services allocates resources more efficiently than when these services are heavily subsidized or taxed.

51 For example, deposit interest rate ceilings provide banks with an incentive to overexpand their branching network. Deposits will be gathered until their extra (interest plus branching) cost equals the extra revenue from making additional loans. As a deposit ceiling results in below-market interest costs, deposits are accumulated until branching costs rise to offset this advantage, leading to more branches than would exist without the deposit rate ceiling. A similar misallocation of resources results from excessive exchange rate controls.

52 Almost all large value payment networks that exist today effectively represent extensions of either check-based or giro-type payments. CHIPS, CHAPS, and BOJ-NET are net settlement networks and represent extensions of an initially check-based (or non-final payment) system of inter-bank transfers. Systemic risk arises because check-based networks implicitly involve the extension of credit by payees to payors, especially when funds received are used intra-day prior to final settlement.
to hold payment clearing balances elsewhere, such as with correspondent banks and thus is more efficient.

Although the historical evolution of large value payment networks has been briefly discussed, this experience is not of great consequence to emerging market economies because the payment technology, the risk perceptions, and the timeframe for large value payments, are so different today compared to the past. The choices presently facing emerging market economies are essentially between net settlement and RTGS systems as they are currently configured, rather than how they may have worked in the past where settlements were performed over a period of days and account balances were monitored only on an end-of-day basis.

Within this context, an important issue concerns the costs and benefits of adequately controlling systemic risk. In a net settlement framework, participants can post collateral covering the single largest net debit (as on CHIPS), post collateral covering all net debits (CHAPS), or have participants in a net credit position loan funds to those with a net debt for a fee (BOJ-NET). In a real time gross settlement framework, participants may hold adequate idle balances (as on SIC) or pay a price for any daylight overdraft incurred (as on Fedwire). The choice among these arrangements depends upon the risk tolerance of a country’s central bank and the degree of control exerted by the central bank over its (privately owned) commercial banks. It also depends on the extent of banking system concentration and the volume and value of large value payments, and their expected future growth, since this determines the net debit to bank equity capital ratio, and hence the likely importance of systemic risk. A net settlement system would be acceptable if a country’s central bank risk tolerance is high, the central bank has little control over commercial banks, the banking system is highly concentrated (more "on us" payments so have smaller net debits), and the volume and value of large value payments is relatively small. Otherwise, a RTGS system may be the preferred option.

The most significant drawback to a RTGS system is its expense to banks and its absorption of bank liquidity. Due to the opportunity cost of (i) holding idle balances to cover payment requests, or (ii) borrowing daylight liquidity from the central bank (or other sources), or (iii) posting collateral to cover daylight overdrafts, there exist incentives to delay making payments until sufficient funds have been received from other participants. This reduces liquidity in the banking system and may, in the extreme case, lead to a payments gridlock in the event that a greater than expected number of large value payments are requested by enterprises and financial markets on a given day. Although alternatives are available, such as splitting up especially large payments into smaller components that are sent in a piecemeal fashion at different times during the day, the liquidity problem is potentially very important in the often unstable monetary conditions in emerging economies when inflation and market interest rates are high.

Another drawback to an RTGS system, although a small one, is that it reduces the incentive for participants to monitor each other’s risk positions, as counterparty credit risk is alleviated with RTGS. However, this problem is less important than if an RTGS system did not exist; while payment

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33 Russia, for example, has recently experienced severe distortions in its interbank funds market due to exceptionally high interest rates. This adverse impact on liquidity could be alleviated if the central bank paid a market interest rate on reserves held for clearing and payment settlement purposes, effectively removing what is in essence a “tax” on large value payments.
participants may be able to effectively monitor the credit risk of a reasonable subset of other participants, the credit exposures they would face would be instead determined by the pattern of payment traffic over a network and the two would not necessarily be the same from day-to-day (Schoenmaker, 1994).

To date, most emerging market economies have implemented or are planning to implement RTGS on their large value payment networks. This holds for China, Viet Nam, Hong Kong, Thailand, Korea, Indonesia, Australia, and other countries of Eastern Europe and the former Soviet Union. While most countries plan to reduce systemic risk on these networks by requiring that net debits be fully collateralized, the countries of the former Soviet Union have required that adequate idle balances be available to minimize the incidence of uncovered net debits to begin with. This raises an important point: in emerging economies the availability of liquidity in interbank money markets is usually quite limited and the banking system is still fragile. Consequently, the very high mandatory reserve requirements often seen in these countries can serve several purposes, such as eliminating systemic risk, avoiding the possibility of a payments gridlock, and reducing the need for the central bank to provide intraday (and overnight) liquidity. However, high reserve requirements are costly to the banking system, although they may be necessary until payment operations and financial markets develop sufficiently to reduce costs by substituting interest earning collateral for idle reserve balances.

In summary, the overall consideration regarding central bank involvement in the payment system concerns the inability or resolute unwillingness of the private sector to provide an environment in which payments can be made in a safe and timely fashion. When such conditions exist, it may be necessary for the central bank to either intervene indirectly by supporting changes in payments laws or other incentives or to intervene directly by taking an active role in payment processing activities to alter the situation. To date, the case for direct intervention is strongest for settlement of all types of payments and in processing large value payments. Additional intervention, by providing for the processing of other non-cash payments, should be considered only on a special case basis and when possible be only temporary.
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