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Before the

**SUBCOMMITTEE ON CAPITAL MARKETS, SECURITIES AND GOVERNMENT-
SPONSORED ENTERPRISES**

of the

COMMITTEE ON BANKING AND FINANCIAL SERVICES

of the

U.S. HOUSE OF REPRESENTATIVES

March 25, 1999

Statement required by 12 U.S.C. § 250:

The views expressed herein are those of the Office of the Comptroller of the Currency and do not necessarily represent the views of the President.

Introduction

Mr. Chairman and members of the Subcommittee, the Office of the Comptroller of the Currency (OCC) is pleased to participate in this hearing on the impact of technological advances on the financial services industry and capital markets. The policy implications posed by technology-driven changes in the financial sector deserve careful review, and I commend the Chairman for holding this timely hearing.

I am James Kamihachi, Senior Deputy Comptroller for Economic and Policy Analysis. At the OCC, my responsibilities include analyzing how changes in the economy and in the financial services industry affect the regulation and supervision of national banks. In addition, I oversee a division staffed by financial engineers who are experts in understanding the models that banks use to measure and manage their financial risks. In recent years, a portion of our work has involved looking at many emerging retail products that banks have under consideration, including electronic money, bank Internet web sites, and electronic bill presentment and payment systems. We, along with the Federal Reserve, have been a major participant in international fora helping government policy-makers understand and appropriately respond to emerging developments in retail banking and payments technologies.

Information technologies have always shaped the production and delivery of banking services and molded the structure of the industry because information is the essence of banking. Banks were among the first businesses to make wide-scale application of mainframe computers. In recent years, the financial services business and the economy are being transformed in more fundamental ways than before due to the rapid decline in the price of computers and the persistent increase in computing power over the past fifteen to twenty years. Traditional boundaries between different sectors of the financial services industry are blurring, and low-cost communications are making it easy for consumers to comparison shop and for institutions to compete on a global basis; markets and major financial services firms are interconnected world-wide. No one can know with certainty where these changes will lead.

My objective this morning is to share with you some observations about how technology is changing the face of banking and financial services, more generally. I will begin by touching on some important technology-driven developments in banking and payments. Then, I will offer some thoughts on how government can meet its obligations to promote the public interest without erecting barriers to innovation. Finally, I will conclude by discussing how the OCC is responding to the impact of technological changes on banking.

Major Technology Breakthroughs Are Relatively Rare

The sheer volume of existing and emerging financial products and services makes it difficult to gain a clear picture of how technology is changing the market. To sort out the most important changes and trends, I find it helpful to refer to an observation recently made by an industry analyst. He argues that fundamental technological breakthroughs in

consumer financial products have been relatively rare; credit cards and ATMs are the primary examples of technology-driven products that have achieved widespread acceptance and have fundamentally altered consumer financial behavior.¹ It is also true that it took a long time for these products to be widely adopted.

Many promising technologies have failed to gain wide acceptance because they did not add enough new value for consumers and businesses to change their behavior. Consider, for example, electronic money. Over the past several years, a number of companies developed e-money products; banks and nonbanks formed ventures to issue, redeem, and otherwise participate in the e-money business; and pilot products received a good deal of attention from the business and financial press. Thus far, however, e-money as a stand-alone product has not had wide appeal to potential users, at least in the U.S., because it has not been viewed as a good substitute for other means of payment.

On the other hand, online brokerage activity has exploded. Just a few years ago, online trading accounted for a negligible share of retail securities trades; now, approximately a quarter of all retail stock trades are done online. It qualifies as a genuine breakthrough in changing how many people invest. Its success has drawn different types of financial services firms into the business. For example, eleven of the 28 largest national banks offer online brokerage.² Five of these house the activity in operating subsidiaries of the bank, while six offer it through a bank holding company affiliate.³ Banks' online brokerages generally are not as large as some Internet-only brokerages or those offered by some traditional securities industry firms; only one is in the top ten. However, the fact that some banks have them indicates that banks are looking beyond their more long-standing "brick and mortar" securities brokerage activities to newer delivery channels.

The stakes are high for government. While many innovations in financial services will not succeed in the marketplace, the potential for new products and services to have tremendous impact on the economy is great. For example, a recent study estimates that the cost of using electronic payment is about one-third the cost of paper-based transactions.⁴ Given that same study's estimate that the cost of a country's

¹ See Marks, James, *Electronic Brokerage: Setting the Pace in Online Financial Services*, Deutsche Bank Research (September 28, 1998), who argues that while there is significant potential for fundamental change in the way we do banking, changing the customs and habits of banking consumers is not easy.

² For supervisory purposes, the OCC groups these banks together into its Large Bank program on the basis of the asset size of the bank holding companies owning these banks. For two of these banking companies, the lead (largest) bank is a state-chartered bank.

³ Both the operating subsidiaries and the holding company subsidiaries comply with SEC requirements for registering as broker-dealers, and the SEC is the primary regulator of these units. The SEC works cooperatively with NASD and NYSE, depending upon with which organization the broker-dealer unit registers.

⁴ Hancock, Diana, and David B. Humphrey, "Payment Transactions, Instruments, and System: A Survey," *Journal of Banking and Finance*, Vol. 21, no. 11 and 12 (December 1997).

payment system may be equivalent to three percent of its GDP, a complete shift away from paper could reduce payments transactions costs for the U.S. economy by \$160 billion annually.

Thus, public policy that affects the pace of technological advancements in financial services must be carefully drawn. To the extent possible, public policy should be guided by a general reliance on the marketplace, and government should avoid policies that stifle innovation. This is necessary to avoid derailing the emergence and application of breakthrough products. It is the convergence of many incremental innovations that provides the foundation for genuine breakthrough products. Commercial use of the Internet is made possible by developments that took place over many decades, including universal telephone service, creation of a network of geographically dispersed servers, and the invention of powerful low-cost computer chips. Where market failures arise, however, government must act. For example, bank regulators must prevent undue risk taking to assure a stable banking system.

The stakes are high for banks. There are three basic issues at stake for banks. First, banks must identify risk exposures related to the deployment of new technologies and the financial products they enable. Given the fast pace and potentially large ramifications of technological change, managers must concentrate more intensely on risk management and strategic thinking. Second, the competitive ground in the financial services business is shifting. In order to maintain existing customer relationships and acquire new customers, banks and other firms must establish their brand image in the digital world. Third, technological advancements are likely to result in lower operating costs for banks. A recent industry study estimates that the average cost to the bank of handling a customer transaction via a telephone call center is \$0.84, compared with \$0.26 via the Internet.⁵ Banks are well aware that those institutions that can switch the most customer transactions to the least costly delivery channels will have a significant advantage over the rest of the industry.

Bankers are responding to these market and regulatory pressures. A recent OCC study reports that banks' capital investment in technology grew by 20 percent in 1996, due in part to a 40 percent increase in investment in information management, which includes such things as data warehousing and data mining.⁶ More recently, an industry study shows that, last year, the banking industry spent \$18.7 billion on information technology, outpacing both the insurance industry's \$17.3 billion and the securities industry's \$12 billion on information technology spending.⁷

⁵ Franco, Stephen C., and Timothy M. Klein, *1999 Online Banking Report*, Piper Jaffray, p. 23 (February 1999).

⁶ See Furst, Karen, William W. Lang, and Daniel E. Nolle, "Technological Innovation in Banking and Payments: Industry Trends and Implications for Banks," *Quarterly Journal*, Office of the Comptroller of the Currency, Vol. 17, No. 3 (September 1998).p. 28. Web address: www.occ.treas.gov/qj/qj.htm. The article is attached to this statement.

⁷ Bank Technology News, Vol. 12, No. 3 (March 1999), p. 3, reporting on a Meridien Research/American Banker study. Note that these figures are not adjusted for Y2K expenditures.

Technological Innovation is Changing the Nature of the Banking Business

Information technology is transforming bank outputs. Traditional products and services have new features, and the range of new offerings is expanding. Entire new lines of business such as derivatives have been created. Banks are also delivering these products and services in new ways. Bank production functions are changing as well. They produce less in-house and buy more from vendors. Powerful, low-cost computers have enabled banks and other financial services providers to make substantial improvements in the sophistication of the quantitative risk measurement techniques they use to manage their portfolios. All of this is causing the structure and competitiveness of the financial services industry to change.

Key developments: banks' outputs. Banks have always been at the center of the payment system. Now, however, technological advancements make it possible to combine and transmit payments with information related to consumer-to-business and business-to-business transactions in ways that lower transactions costs and offer a high degree of convenience. This integration of payment systems, which previously had been viewed like plumbing -- important, but unseen and taken for granted -- with other transaction information has resulted in an increasingly visible set of new products, over which many financial and nonfinancial firms are beginning to compete. Three outputs are of particular interest in this vein: banking over the Internet, electronic bill presentment and payment, and financial electronic data interchange.

Banking over the Internet has sparked much comment among consumers, businesses, and government. It is clear the Internet is changing the kinds of products banks offer and the way they deliver them. Customers can apply for loans, receive information about bank products, and in some cases move funds between accounts and pay bills over the Internet. These developments have moved the use of electronic technology out of the back office and into the design and delivery of business-to-business and consumer-to-business banking products.

OCC staff recently completed a comprehensive review of Web banking, and found that very few banks currently offer transactional Internet banking.⁸ This study defines "transactional" Internet banking as providing customers the ability to access their accounts and, at a minimum, transfer funds between accounts. As of June 30, 1998, less than 5 percent of all commercial banks--374 commercial banks--had transactional Web sites. Large banks are much more likely to offer transactional banking over the Internet, but the study also finds that some small banks offer this service as well, leading to the conclusion that the fixed costs of offering transactional Internet banking are not

⁸ Eglund, Kori L., Karen Furst, Daniel E. Nolle, and Douglas Robertson, "Banking over the Internet," *Quarterly Journal*, Office of the Comptroller of the Currency, Vol. 17, No. 4, pp. 25 -30 (December 1998). Web address: www.occ.treas.gov/qj/qj.htm. The article is attached to this statement. The database for this study included all FDIC-insured banks and thrifts with Web sites, except the handful of "Internet-only" banks and thrifts. We did not include PC banking activities conducted over a bank's own dial-up (i.e., non-Internet, proprietary) system.

prohibitive for small banks. Indeed, a recent report in the banking press indicates that not only is it possible for small banks to provide online banking for their customers, but at least a few small banks have excelled at providing this service.⁹

The OCC study also points out that banks offering transactional Internet banking already have a large potential customer base. As a consequence, it is conceivable that Internet banking could achieve breakthrough status very rapidly. These banks account for approximately 40 percent of all household deposits, and we estimate that this number could grow to 50 percent by the end of this year. Of course, questions remain about whether and when banks will develop this product into one sufficiently superior to traditional delivery channels to win broad customer acceptance.

In a basic sense, payment transactions are information transfers that credit and debit accounts. However, most transactions involve additional information exchanges accompanying the credit and debit instructions. Today, electronic payment instructions are typically accompanied by additional transfers of information that are completed through traditional, and relatively costly, paper-based means. For example, most companies must mail paper bills to customers even if the customer pays the bill electronically. A part-electronic, part-paper system may be only a marginal improvement in efficiency relative to an all-paper environment. But, end-to-end “electronification” of consumer-to-business and business-to-business transactions can yield tremendous additional benefits.

Electronic bill presentment and payment (“EBPP”) is a new development that may become a breakthrough consumer-to-business product. Currently, some banks and nonbanks offer electronic bill payment services to customers. Though relatively new for consumers, and not yet widely used, the use of electronic bill payment more than doubled in 1997 compared to 1996.¹⁰ Electronic bill presentment, which is just beginning to emerge as a practical reality, eliminates paper from the beginning of the process. As use becomes more widespread, more businesses may gear up to receive electronic payments, squeezing additional paper out of the last link in the process. Taken together, electronic bill payment and presentment would provide an end-to-end electronification of consumer-to-business payments.

For business-to-business electronification of transactions, financial electronic data interchange (EDI) is a fully operational reality, and has begun to take off, doubling between 1995 and 1997, and growing an additional 43 percent in 1998.¹¹ Financial EDI is the process of bundling together payments and related information on sales, inventory,

⁹ See Senior, Adriana, “Small Banks Now Ranked in Web Banking Big Leagues,” *American Banker*, vol. 164, p. 11 (March 18, 1999).

¹⁰ Furst, Lang, and Nolle, op. cit., p. 27.

¹¹ Furst, Lang, and Nolle, op. cit.; and National Automated Clearing House Association (NACHA) *News Release* (February 1, 1999).

and production information. This process allows businesses to reduce operating costs substantially.

Key developments: banks' production functions. Advancements in information technology have changed the way banks can most efficiently produce services. One major change in bank production functions is the degree to which they are turning to outside service providers, rather than attempting to handle all of their production processes in-house. The growing sophistication of new products and services, and the growing complexity of new delivery channels, may make outsourcing not only a more efficient choice, but for many banks, especially smaller ones, the only realistic choice. In addition, banks of all sizes are finding it increasingly difficult to hire and retain the kinds of expertise needed to produce and deliver new products and services.

Increased reliance on financial engineering represents another change in bank production functions. Advancements in information technology allow financial institutions to develop and use sophisticated mathematical and statistical models to more precisely assess, price, and manage risks.

Key developments: banking industry structure and competitiveness. Banking industry structure and competitiveness are affected greatly by advancements in information technology. Two examples serve to illustrate this point. Consider the ongoing consolidation of the banking industry. In the last ten years, the number of commercial banks decreased by over 4,000 institutions, largely due to mergers. Roll-ups of subsidiary banks by bank holding companies into fewer and fewer separate charters accounted for approximately half of all mergers. To the extent it is important to centralize transactional information, technological advancements give added impetus to the drive by bank holding companies to reduce the number of separately chartered bank subsidiaries.

Technological innovations are also opening the door for nonbanking firms to get into the core business of banking as never before. For example, some on-line brokers are planning to offer electronic bill payment and bill presentment services to their customers. Nonfinancial firms are increasingly entering the small business loan market by using credit scoring models to process loan applications. Whether nonbank firms will elect to compete with banks or partner with them in offering electronic banking and payments products remains to be seen.

OCC's Supervision is Adapting to Technological Innovations in Banking and Payments

Emerging technology provides tremendous opportunities for improving the efficiency and quality of financial services. If we are to achieve these benefits, government must refrain from unnecessarily interfering with the market forces propelling technological innovation forward. The OCC has worked domestically and internationally towards this end, and to focus the attention of bank regulators on areas where markets may fail to address the concerns raised by emerging retail banking and payments

technologies. These include taking steps to ensure financial integrity, to protect consumers, and to deter financial crimes.

In the current environment of rapidly changing technology, financial integrity rests fundamentally on identifying and managing risks. There are several important categories of risks facing banks and other financial institutions: (1) financial risks, including credit, price, foreign exchange, and interest rate risk; (2) transactional risks, such as security and operational problems; (3) strategic risk, for example understanding how technology fits into the institutions' business plan; and (4) legal and reputational risk, including an understanding of how other risks may have legal and reputational consequences for the institution.

Fundamental consumer protection issues include making adequate disclosures about how new systems and products work, so that consumers can make informed choices about the relative merits of different products; making clear statements for consumers about their rights and obligations with respect to new products and delivery channels; and addressing customer concerns about privacy. Deterring financial crimes rests on designing products with adequate safeguards against criminals, and educating company employees, contractors, and customers about proper precautions.

The OCC has issued guidance for banks and for examiners on risk management procedures for new technologies. For example, our broad guidances on Technology Risk Management, and on PC banking, cover the major categories of risk on which banks should focus. We have also published guidances tailored to particular technology products or issues, including electronic stored-value, credit-scoring, and threats to the information system infrastructure of banks.

The OCC is also working diligently to adapt its supervision to changes in the banking industry. We are undertaking a review of our Bank Information System (BIS) examination program to ensure that OCC supervision is keeping pace with bank use of technology, and the increasing reliance on vendors and service providers. The widespread use of vendors and service providers in the banking industry means that, in order to evaluate a bank's exposure to transactional failures, we must understand the condition and operation of both the bank and its servicer.

We are also making sure we have the skills we need to understand the increasingly sophisticated technologies banks use. For instance, the OCC is improving the training our BIS examiners receive, and is increasing the number of our examiners who have received industry-recognized certification. Currently, more than two-thirds of our BIS experts are Certified Information Systems Analysts. In the area of financial engineering, the OCC is doubling the number of staff who can evaluate the models banks use. When fully staffed later this year, the division within the Economics Department that provides that support to our examination teams will have 20 Ph.D. economists -- two for every three of our largest banks.

Conclusion

Advancements in information technology are crucial to the continued vitality of the banking industry. As bank regulators, we must avoid unnecessarily distorting or hindering such advancements. At the same time, we must fulfill our responsibility to see that the integrity of the financial system is not compromised, that consumers are adequately protected, and that criminal activities are prevented. We are working hard to ensure that we understand new developments in financial markets, that we maintain the expertise needed to oversee new products and applications, and that we supervise national banks to make sure they are appropriately managing the risks growing out of applying new technology to banking.

Special Studies on Technology and Banking

Technological Innovation in Banking and Payments: Industry Trends and Implications for Banks

by Karen Furst, William W. Lang, and Daniel E. Nolle¹

Introduction

The revolution in information and communication technologies has become central to developments in the banking and financial services industry. Most banking industry analysts include technological change on the short list of important factors underlying the dynamics in banking industry structure and performance. For example, improvements in information management are playing a key role in enabling banks to take advantage of expanded powers and reductions in geographic restrictions. More complete and speedier access to customer information is allowing banks to more effectively manage complex customer relationships and to “cross-sell” additional financial services. In addition, technology has been a motivating factor for many of the recent large bank mergers, as institutions with less efficient technology management seek out merger partners with better technology management.

In recent years, technology has become increasingly important to the evolution of bank retail delivery systems and the development of new electronic retail products. The ability to deliver new advanced technology products reliably has become a central theme in the marketing strategies of a growing number of banks. Most institutions see introducing new products and services such as PC (personal computer) banking as a necessary step for retaining highly valued customers, and for positioning themselves strategically for the future. As this trend continues, the nature and magnitude of risks posed by technology will continue to change, and these changes will pose significant challenges for banks and banking supervisors.

A key to responding to these challenges is having a clear picture of the changing banking and payments landscape. This article describes that landscape, focusing in particular on changes in “retail” payments (i.e., business-to-business and consumer-to-business payments). We begin with a brief description of the significant shift in the United States toward electronic means of payment in retail transactions. The article then addresses important developments taking place in the nature and pattern of electronic payments processes. Some of these develop-

ments involve the adoption of new processes, while others reflect a recent surge in the use of technologies that have existed for a number of years. In both cases, these processes combine the electronic transfer of payment related information with the actual payment instructions. While much attention has centered on the shifts away from paper-based payment media, the development and adoption of processes that broaden the scope of information transferred electronically in the course of a payment transaction will likely have a greater long-term impact on electronic commerce and banking.

We discuss the response of banks to these technological developments, and the challenges arising for bank management in the fourth section of the article. Banks are substantially increasing their investments in technology, and we present information on the composition and magnitude of those investments. Our analysis indicates that banks are feeling strong competitive pressures to avoid being left behind in the technology area. This sense of urgency could lead to heightened technology-related risk exposures for banks if they fail to implement appropriate technology risk management practices. We then briefly discuss the steps taken by bank regulators to help institutions develop sound risk management measures. The article concludes with a summary of our key observations.

Developments in Electronic Payment Media

Analysts divide payments into “wholesale” and “retail” payments. Wholesale payments consist of very large value payments, especially interbank payments related to banks’ clearing and settlement role.² Retail payments

² The terms “wholesale payments” and “retail payments,” while not precise, are commonly used, even in official descriptions of payment systems. See, e.g., the section describing the U.S. payment system in detail in Committee on Payment and Settlement Systems (1993). For a recent description of advances in wholesale payment systems see Emmons (1997).

The average value of a wholesale payment in 1996 was \$4.3 million. Thus, while wholesale payments account for less than 1 percent of the number of payments in the United States, they account for almost 90 percent of the value of all payments. The average value of a retail transaction varies by payment medium. In 1996, the average check transaction was \$1,158; the average credit card purchase was \$61; the average debit card transaction was \$37; and the average automated clearing house (ACH) payment was \$3,283.

¹ The authors are grateful to Kori Egland for excellent research assistance, James Kamihachi and David Nebhut for helpful comments, and Rebecca Miller for editorial assistance.

include consumer-to-business and business-to-business payments. Wholesale payments have long been electronic, though technological advances are continually being made. Technological advances in retail payments have also been continual, but recent rapid increases in the pace and scope of such changes has drawn much attention in the financial community, the business press, and among the public at large.

In the United States, retail payments are heavily paper-based. Recent Bank for International Settlements (BIS) and National Automated Clearing House Association (NACHA) data show that approximately 97 percent of retail payments in the United States are made with either cash (about 87 percent) or checks (about 10 percent), with less than 4 percent of retail payments being made electronically. While it is difficult to estimate precisely the use of cash in an economy, it is clear that cash is the overwhelming choice for conducting small-value transactions.³ However, in terms of dollar-value, NACHA estimates that cash accounts for less than 3 percent of retail payments. The data also show significant growth in the use of electronic payment media—credit cards, debit cards, and automated clearing house (ACH) payments, including ACH credit transfers such as direct deposit of payrolls, and ACH direct debits such as automatic mortgage payments.⁴

In 1996 (the latest available BIS data), payment with electronic media accounted for over 25 percent of noncash retail payments, up from 18 percent at the beginning of the decade, as Figure 1 illustrates. In terms of number of transactions, credit cards are ahead of both ACH transactions and debit cards, accounting for almost three-quarters of all electronic retail payments in the United States. Hence, the nearly 40 percent increase in credit card transactions over the 1992-to-1996 period contributed substantially to the overall shift toward electronic retail payments. However, the most startling growth was in debit card use, as Figure 2

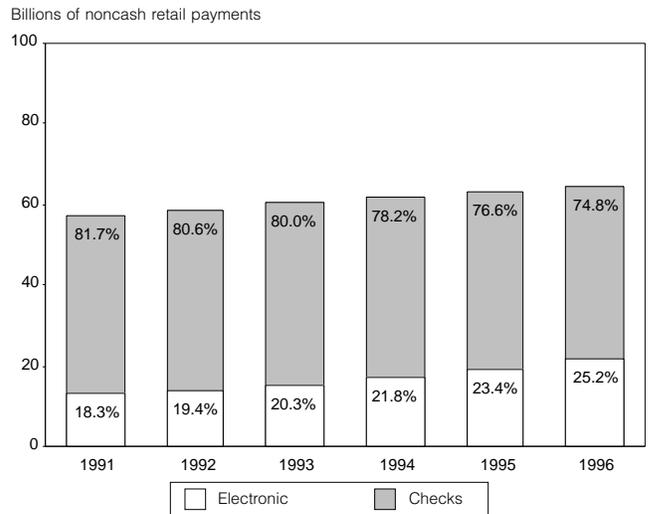
Average ACH payment size is substantially larger than other forms of retail payments because ACH transactions include direct deposit of payrolls by businesses, as well as relatively large consumer-to-business payments such as automatic mortgage payments.

³ Unlike the BIS data on noncash payments, which are widely considered to be accurate, estimates of cash usage are notoriously difficult to make and therefore are considered, at best, ballpark-type figures. On the problems associated with the estimation of cash usage, see Hancock and Humphrey (1997).

⁴ See Committee on Payment and Settlement Systems (1997). The G-10 countries include Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, Sweden, the United Kingdom, the United States, and, since 1984, Switzerland as the eleventh member of the group.

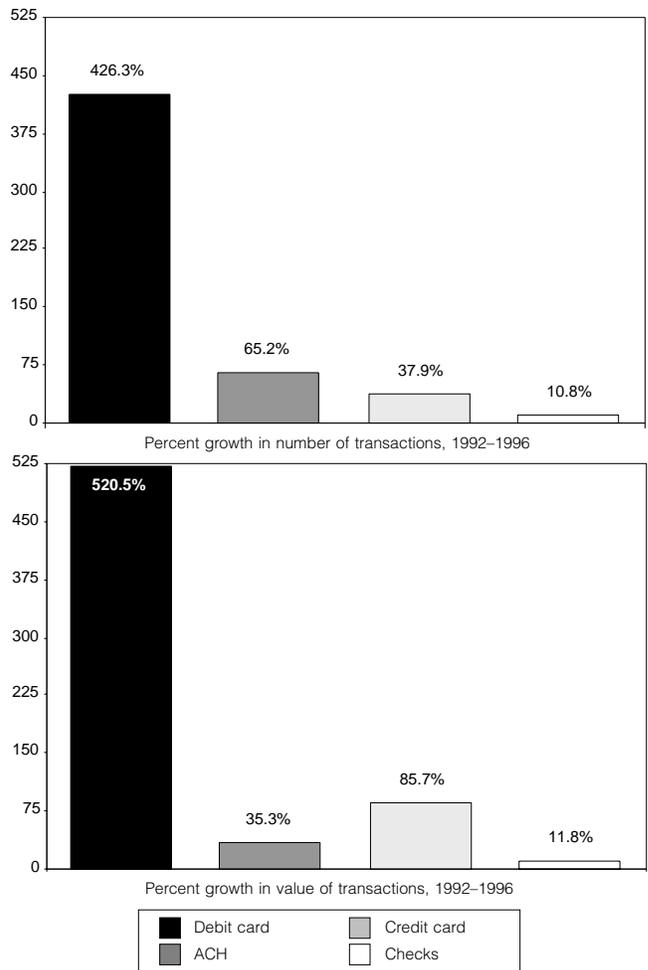
Though there is wide variation in the relative proportion of paper-based versus electronic payments in the Group of Ten (G-10) countries, each of those countries has experienced a significant shift to greater reliance on electronic payments over the past five years.

Figure 1—Electronic retail payments growing in importance



Source: Office of the Comptroller of the Currency, using data from Committee on Payment and Settlement Systems (1997), *Statistics on Payment Systems in the Group of Ten Countries: Figures for 1996*, Bank for International Settlements, and from the National Automated Clearing House Association (NACHA).

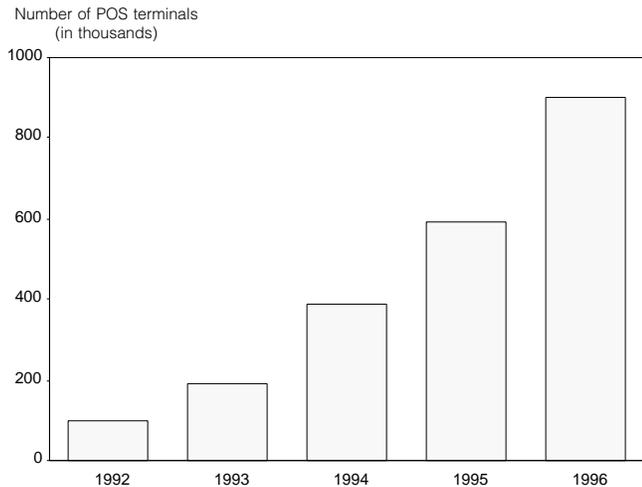
Figure 2—Debit card use explodes



Source: Office of the Comptroller of the Currency, using data from Committee on Payment and Settlement Systems (1997), *Statistics on Payment Systems in the Group of Ten Countries: Figures for 1996*, Bank for International Settlements, and from the National Automated Clearing House Association (NACHA).

shows. Though currently accounting for less than 12 percent of retail electronic payments, debit card use soared four-fold in volume terms and five-fold in value terms from 1992 to 1996. Many debit card transactions occur at point of sale (POS) terminals, and Figure 3 shows the correspondingly steep growth in number of POS terminals over the 1992-to-1996 period.

Figure 3—Steep growth in point-of-sale terminals



Source: Office of the Comptroller of the Currency, using data from Faulkner & Gray, *EFT Network Data Book* (various issues).

Because debit card transactions substitute for paper checks, and, to a far lesser extent, for cash, the potential for growth of debit card use is vast. American consumers currently write an estimated 12 billion checks annually at the point of sale. If only half of those payments were made by debit cards instead of checks, merchants could save an estimated \$1.73 billion.⁵ More generally, greater use of electronic payments not only enhances convenience, but can cut costs for consumers, businesses, and banks. One study estimates that the cost of using electronic payments is about one-third the cost of paper-based transactions.⁶ Given the same study's estimate that the cost of a country's payment system may be equivalent to 3 percent of its GDP, a complete shift away from paper could therefore reduce payments transactions cost for the U.S. economy by \$160 billion annually.

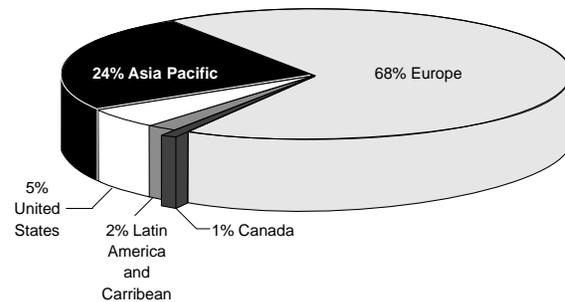
While the use of credit cards, debit cards, and ACH has grown significantly, use of electronic stored value ("e-

⁵ In a recent study, the Food Marketing Institute (1998) includes a detailed comparison of transactions costs for supermarkets to handle customers' payments using various payment instruments. Our estimate of the savings was calculated by taking the difference between the cost to handle a transaction by check (\$0.5827) and a transaction by on-line debit (\$0.2892), multiplied by 5.9 billion (i.e., one half the 11.8 billion checks written by consumers at the point of sale per year in the United States).

⁶ See Hancock and Humphrey (1997).

money") has progressed slowly in the United States.⁷ This stands in contrast to the growing use of e-money in other areas of the world, as indicated in Figure 4. Though there are no widespread open e-money systems operating in the United States, there has been steady growth in e-money use within limited systems on college campuses, military bases, and athletic stadiums.

Figure 4—Example of worldwide use of e-money



Source: Office of the Comptroller of the Currency using data on Visa's general-purpose, stored value chip cards, from Visa (1997), *Chip Card Programs Around the World*.

Some analysts question whether there is a significant business case for open-system e-money as a substitute for cash in small-value transactions. Other analysts believe that e-money use will become more widespread when consumers gain confidence in the security and reliability of e-money, and when e-money is combined with other electronic payment media such as debit and credit cards.⁸

Developments in Electronic Payment Processes

The development of electronic payment media can be seen as the spearhead for broader developments in

⁷ Electronic money (e-money) refers to prepaid payment mechanisms ("stored value") for making payments at point-of-sale terminals or over open computer networks. Some e-money devices also enable users to make direct transfers between devices. Stored-value products include card-based mechanisms (also called "electronic purses") and network-based mechanisms (also called "digital cash"). Although stored-value cards can be "single-purpose"—e.g., telephone cards—general use of the term "e-money" has come to be more commonly associated with stored-value cards that can be used for multiple purposes. Because of security and increased functionality, most analysts believe that card-based e-money requires the use of cards that have a computer chip embedded in them (so-called "smart cards") rather than cards using magnetic stripe technology. As pointed out in a G-10 study on e-money, a single precise definition of e-money is difficult to provide, in part because of technological changes. See Group of Ten (1997) and Basle Committee on Banking Supervision (1998) for discussions of this issue.

⁸ For recent discussions of security issues surrounding electronic money, see Committee on Payment and Settlement Systems and the Group of Computer Experts (1996), Group of Ten (1997), and Richards (1997).

electronic payment processes and electronic banking. In their most narrow sense, payment transactions are information transfers that credit and debit accounts. However, most payment transactions involve additional information exchanges accompanying the credit and debit instructions. For example, paper payment transactions typically involve the delivery of receipts or invoices. Many analysts and industry participants believe that the next great source of value and innovation in electronic retail payments will come from expanding the scope of the information exchanged in end-to-end electronic business-to-business and consumer-to-business transactions.

Currently, electronic payment instructions are typically accompanied by additional transfers of information, which are completed in the traditional paper-based way. For example, most companies must mail paper bills to customers even if the customer pays the bill electronically. "Electronic" bill payment instructions are often sent to a third party that provides a biller with a paper list of the "electronic check" information that must then be entered manually into the biller's system. In many cases, a part-electronic and part-paper system may be only a marginal improvement in efficiency relative to an all-paper environment. However, incorporating all of the transaction information into a smooth and efficient end-to-end electronic transaction has the potential to generate great efficiencies for both consumers and businesses through the elimination of the relatively costly paper components of transactions.⁹

This perceived potential for efficiency gains is driving investments in these processes, and it also explains the motivation behind the intense competition by banks and other businesses to become leaders in the implementation of new payments processes. While banks currently play the central role in the payment system, the extent of their future role in these expanded electronic retail payment processes is far from certain.¹⁰ Banks may be able to leverage their current dominance in the payment system to become the dominant force in the new retail payment system. Alternatively, banks could play a relatively narrow role of maintaining transactions accounts, while nonbanks engage in higher value activities associated with new electronic retail payments processes.

⁹ See, e.g., Microbanker (1997), Phillips Business Information Inc. (1998), and Clark (1998) for discussions of this issue.

¹⁰ Increasingly, nonbank firms—including nonfinancial firms—are providing payment system services. In some respects such entities may compete directly with banks, but a bank-versus-nonbank dynamic is not the only possible outcome, inasmuch as banks and nonbanks can, do, and will form alliances and joint-ventures to exploit new technology opportunities. An important area for future research is to describe and analyze this activity and the policy issues emerging from it.

Business-to-Business Payment Systems

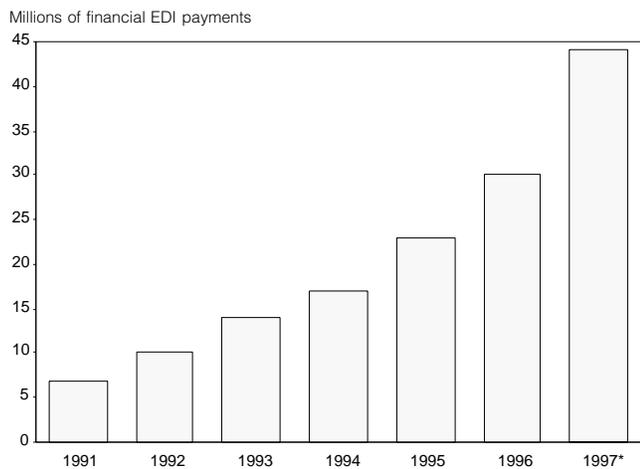
In the last several years there has been considerable growth and investment in electronic data interchange (EDI). Currently EDI is the principal system used by companies to transmit purchase orders and corresponding shipping and invoicing information to one another electronically. This enables information to automatically feed into inventory management and accounting systems within each company. Such information exchange allows businesses to substantially reduce operating costs. Financial EDI (FEDI) is the process of integrating payments with this commercial transmission of sales, inventory, and production information.

For example, when a consumer purchases a tool at a retail chain store, inventory management information is generated within the store from the point-of-sale terminal, and (once a set inventory drawdown has been reached) the electronic equivalent of a purchase order is transmitted to the toolmaker. The toolmaker ships the tools and electronically sends an invoice to the store. When the store receives the invoice, that information is routed to its accounts payable. At this point, the EDI transaction becomes a FEDI transaction if payment instructions (the amount to be paid and whom to pay) is electronically transmitted to the store's bank. The bank in turn makes an ACH payment (complete with associated information on the nature of the payment) to the toolmaker. In a variation on this procedure, payment instructions could go to an EDI-capable nonbank entity, which would arrange for payment to be made instead of the bank playing this role. Ultimately, the store's account will be debited by its bank.

Though financial EDI has been available for two decades, it is only in the last few years that its use has taken off, doubling between 1995 and 1997, as Figure 5 shows. Until recently, only the largest businesses and banks were capable of handling EDI transactions because of the high cost of EDI software. This situation has been changing as the costs of EDI-related software has declined significantly in the last several years. This decline in cost will receive an added boost at banking institutions later this year when the Federal Reserve distributes free software that allows banks to translate EDI payment information.

The growth in EDI use is itself increasing the incentives for a firm to become EDI-capable. Many of the costs of becoming EDI-capable are related to one-time set-up costs. These fixed costs are offset by the increased efficiency of information flows. The greater the number of transactions that can be completed using EDI, the greater are the efficiency gains and the more likely these gains will offset the set-up costs. This is an example of what economists refer to as "network externalities," where

Figure 5—Business-to-business electronic payments increasing rapidly



*Projected 1997 figures.

EDI—electronic data interchange.

Source: Office of the Comptroller of the Currency, using data from National Automated Clearing House Association (NACHA).

the value of a firm adopting EDI is positively related to the number of other firms that have adopted this technology.

Growth in the number of EDI-capable banks is likely to continue because EDI capability is now becoming a requirement for effectively servicing many large business customers. In addition, banks may decide to compete with nonbanks as suppliers of a wide range of services related to the receipt or disbursement of commercial payments.¹¹

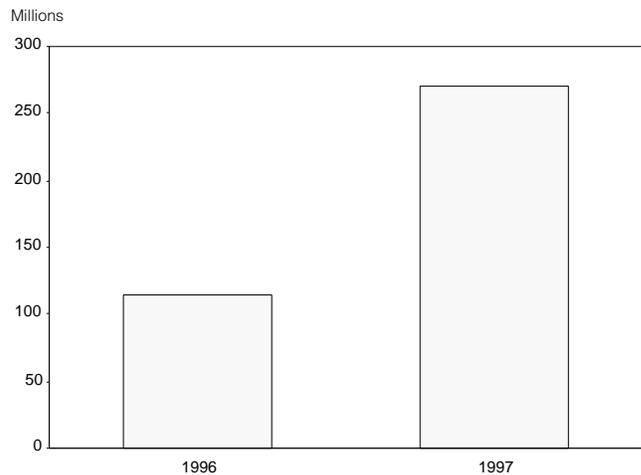
Consumer-to-business payment systems

Consumer-to-business payments technology is another area of rapid change in which banks and nonbanks are making major investments. As with EDI, there is a significant possibility that this market could continue to grow at a rapid pace. Two main aspects of the “electronication” of consumer-to-business transactions are electronic bill payment and electronic bill presentment. With electronic bill payment, a consumer issues payment

¹¹ As a part of their cash management services, banks may offer a comprehensive payables service where a company could send an electronic file to the bank with instructions for all payments (both paper and electronic), and the bank would make the payment in the format specified. Companies may also outsource accounts receivable, such as lockbox services where the remittance data is converted from paper documents (e.g., checks and coupons) to an electronic format during lockbox processing. This electronic data is then transmitted to the company. One of the advantages to a company using these services is that payment information is reported back to the company in a standard format regardless of how the payment or payment information is received by the bank or service provider.

instructions by telephone or by personal computer to his bank or a nonbank firm offering bill payment services. Currently, the bank or bill payment firm completes the bill-paying process by initiating an ACH transaction or by writing a check.¹² Though relatively new for consumers and not yet widely used, the use of electronic bill payment, shown in Figure 6, more than doubled in 1997 compared to 1996.

Figure 6—Very rapid growth in number of electronic bill payment transactions



Source: Office of the Comptroller of the Currency, using data from Coopers & Lybrand as reported in Marjanovic (1998).

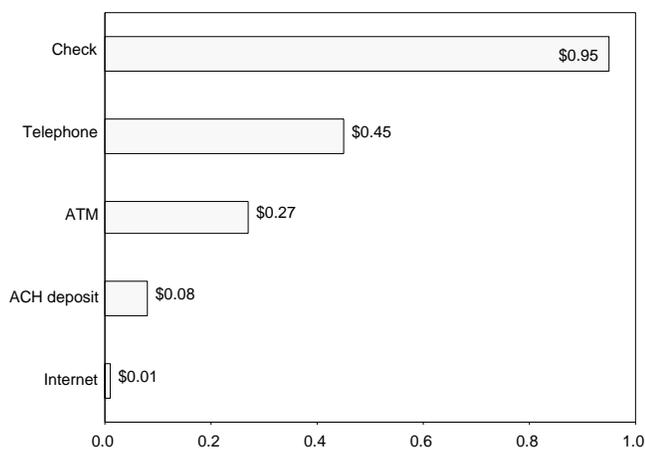
Combining electronic billing with electronic payment can substantially increase the convenience and efficiency of consumer-to-business transactions. Electronic bill presentment is emerging as a practical reality, with several competing alternatives vying for acceptance. “Presenters”—i.e., firms engaged in providing electronic bill presentment services—are creating an electronic version of client businesses’ bills. Consumers could then receive these bills in several ways. Consumers could visit their billers’ Web sites and retrieve electronic bills from each business. Another model calls for consumers to visit presenters’ Web sites for billing information. Alternatively, a bank might collect electronic bills for its customers, who then visit the bank’s Web site for billing information. Consumers could also arrange for billers, presenters, or banks to deliver bills electronically to them as e-mail. Electronic bill presentment has the potential to enable a business to incorporate the receipt of an electronic payment into its accounting system more efficiently and accurately.

¹² Pre-authorized debits such as automatic mortgage payments, which give a consumer’s mortgage holder the ability to originate an ACH transaction for payment by the consumer’s bank, are not included as electronic bill payment because the initiation of each monthly transaction is not controlled by the consumer.

Banks' Response: Substantial Increases in Technology Spending

Technological innovation can increase profitability either through enhancing revenues or lowering costs. Figure 7 illustrates the substantially higher costs for banks of conducting customer transactions via paper checks compared to electronic means. For example, a transaction handled via the Internet may cost a bank about one cent, versus almost a dollar to handle a deposit by check over the counter at a branch office. Benefits may also come from preventing erosions in profitability and market position as banks and nonbanks compete in these emerging markets.

Figure 7—Banks have cost incentives to encourage electronic payments



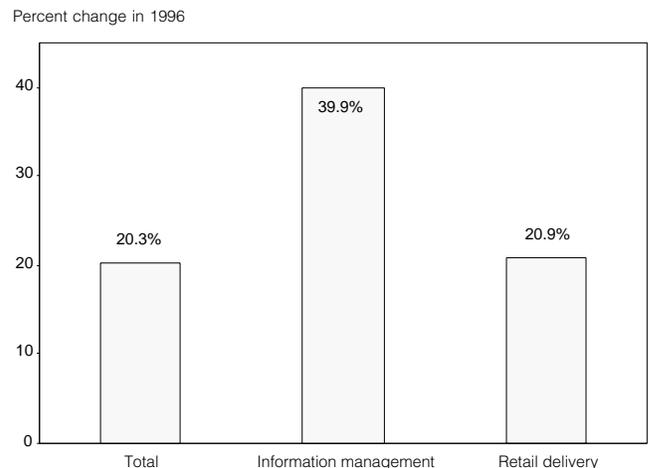
Note: Estimated cost per transaction. For checks, figures are for deposit by check using a bank teller.

Source: Office of the Comptroller of the Currency, using data from Faulkner & Gray (1997) and from the National Automated Clearing House Association (NACHA).

Banks boosted technology investment spending strongly to address revenue, cost, and competitiveness concerns. One recent study estimated a 20 percent increase in total technology spending by banks in 1996, to \$27.8 billion, approximately one-quarter of which (\$5.2 billion) went for capital investment in technology.¹³ As Figure 8 illustrates, the biggest leap in banks' recent technology investment spending was for information management, which increased almost 40 percent over the previous year. Information management investment spending includes the development of data warehousing (the collection and storage of vast amounts of data on customer relationships from various systems), and data mining (integration and

¹³ These figures are from Faulkner & Gray (1997). "Total technology spending" includes purchases of new equipment, software, and information systems, as well as personnel expenditures. Definitions of what constitutes "technology spending" and "investment in technology" vary widely, and it is therefore difficult to make precise comparisons between sources.

Figure 8—Bank technology investment: substantial increases



Source: Office of the Comptroller of the Currency, using data from Faulkner & Gray (1997).

analysis of data). A key aim of this investment is to enhance the efficiency and revenue-generating potential of both traditional delivery channels such as branches, automated teller machines (ATMs), and call centers, and new delivery channels such as Internet banking.

Many banks are counting on a payoff in the near-term from technological improvements in their traditional delivery channels. In particular, many banks hope to increase marketing and "cross-selling," i.e., the sale of additional products and services to a customer based on an analysis of data about the customer's current purchases of products and services.¹⁴ They look for such an outcome as a direct result of technological improvements in branches and call centers, underpinned by investment in data warehousing and data mining. Consistent with this expectation, banks increased technology investment in retail delivery channels by 21 percent (see Figure 8). Approximately half of this increased investment was allocated to improving the delivery and management of customer information at branches in order to enhance the ability of bank personnel to access information on all of a customer's business with the bank. A majority of the remainder of the technology investment in retail delivery channels was allocated to improvements in ATMs and telephone banking and call centers.

The analysis is somewhat different when it comes to investments in other new technology products and services. Banks are making investments in new electronic

¹⁴ We are not aware of any definitive study demonstrating the profitability of cross-selling, though its virtues are increasingly touted in the business press. See for example Moyer (1998). To establish the efficacy of cross-selling in an analytically sound manner will require grappling with issues such as how a bank can precisely measure both the costs for establishing and operating cross-selling activities, and the returns earned by each "cross-sale."

Table 1—Most important motivation for three types of banking technology

	Installing and upgrading ATMs		Offering PC banking		Data warehousing	
	Banks with large networks	Banks with small networks	All banks (according to GAO survey)	All banks (according to Mentis survey)	Large banks	Small banks
Motivation:						
Response to competitive pressures	X	X	X	X		X
Revenue enhancement					X	
Cost reduction						

Source: Office of the Comptroller of the Currency, using data from Faulkner & Gray (1997); General Accounting Office (1998); and Mentis Corporation (1998).

products and services, such as PC banking, even though the actual volume of transactions using these products is still relatively small, and these products have little direct impact on a bank's bottom line. Why then are so many banks expressing a desire to introduce PC banking and other electronic payment systems? Table 1 shows that the perceived need to respond to competitive pressures is the primary driver for banks' investments in many of the new electronic technologies, as compared with revenue enhancement and cost reduction. Many banks are concerned that they will lose profits and market share over the long run if their competitors are better able to take advantage of these low-cost delivery channels. In addition, banks are concerned that higher-income customers who use multiple bank services will be attracted to institutions offering these new technology products. Banks are facing crucial strategic decisions concerning when to enter the market, and how to maintain sufficient flexibility given rapid changes in technology.

Are Banks Rushing into Technology Decisions?

There is considerable evidence that banks are planning to continue significant expenditures on introducing new technology products.¹⁵ However, in some areas, banks' plans may be overly ambitious. For example, though less than 3 percent of banks currently offer customers the ability to access their accounts via the Internet for transactional purposes, a GAO survey of bankers estimates that almost half of all banks say they intend to offer PC banking by the end of this year. Other surveys report similar results.¹⁶ Such expectations may be unrealistic;

however, they highlight the sense of urgency about technology within the banking community.

Given existing market pressures and the urgency many bankers feel about the necessity of adopting new technology, a "leap-before-you-look" pattern of behavior could emerge if banks do not develop an appropriate approach to managing technology risks. Further, the possibility that some senior bank managers are poorly informed about technology risks faced by their bank is another potential cause for concern.¹⁷ An appropriate risk management system will guard against the urge to invest in new technology without first developing a fundamental understanding of the risks involved.

Increased use of technology in banking and payments is likely to raise consumer protection issues as well. Because technological advancements greatly enhance the ability of banks and other financial institutions to collect and use vast amounts of information, concerns arise about appropriate privacy safeguards. In addition, consumers will wish to have a clear understanding of their rights and responsibilities in using new systems and products, and will want to know how financial institutions intend to resolve disputes in the event of errors or malfunctions. In the midst of their efforts to adopt new payments and banking technologies, banks that fail to effectively address such concerns are likely to erode or destroy customer trust.

The Response of Bank Regulators

Bank supervisory authorities have recognized the important challenges posed by the rapid advance of technology and have devoted increasing attention to technology-related issues. In the United States, the OCC and other federal regulatory authorities have recently published

¹⁵ Several estimates of banks' technology spending in 1997 show spending levels below the Faulkner & Gray (1997) figures for 1996 technology spending. Though these studies are not strictly comparable to each other, a decline in new technology spending accords with recent reports in the business press suggesting that banks may be becoming somewhat cautious about spending on new technology in the face of challenges posed by addressing the year-2000 problem.

¹⁶ See, e.g., General Accounting Office (1998), and Mentis Corporation (1998). A "transactional" Web site allows a customer to engage in activities such as account inquiry, funds transfers between accounts, bill payment services, and loan applications.

¹⁷ The year-2000 problem complicates the issue further. As bankers' awareness of the difficulties facing them in this respect grow, they may be forced to cut back spending on new technology, heightening their fears about "falling behind." Alternatively, if some banks feel the need to go ahead with technology plans regardless of strains on resources caused by dealing with the year-2000 problem, risk exposures could rise.

guidance that helps banks identify and prioritize risks, and which suggests possible risk management measures.¹⁸ Internationally, the Basle Committee on Banking Supervision, whose members include bank regulators from the G-10 countries, has also recently published a report on risk management for electronic banking activities.¹⁹

These various supervisory documents do not address in detail the new technology products being introduced into the market. Rather, they contain common themes that are useful for managing risk in the technology area. First, basic steps in the risk management process include assessing risks, implementing appropriate measures to limit risk exposures, and monitoring risk exposures. Second, while it is conceivable that technology activities may raise a wide variety of risks, banks and supervisors are likely to be particularly concerned with transactional risks, including security risks, as well as reputational and legal/compliance risks. Third, in an environment that will continue to change rapidly, it is crucial that bank management establish and promote two-way communication between the organization's technical experts and senior decision makers. Finally, transparency is central to addressing consumer protection concerns. Banks should strive to explain clearly their intentions regarding collection and use of personal information, as well as product features, costs, and dispute resolution procedures.

Summary and Conclusions

Our analysis yields several key observations:

- There has been a significant shift by consumers and businesses to electronic payments. In some areas of consumer and business electronic payments there are indications that the market may be poised for a rapid and substantial expansion of transactions volume in the near term.

- Significant innovation and investment is under way that could lead to very rapid expansion in fully electronic business-to-business and consumer-to-business payments in the near term. While the pace of change in these markets is difficult to determine, eventually these innovations will generate substantial efficiencies in retail payments systems.
- In response to developments in electronic payments and remote banking, banks have greatly increased their investment in technology, particularly in retail banking. For some activities, banks hope to see a near-term impact on profitability. Other investments are motivated more by a desire to establish a competitive position or avoid falling behind the competition.
- Survey evidence reveals a sense of urgency about the adoption of new technology and reflects substantial competitive pressures to act quickly. Such pressures may heighten the chance that some banks will rush into technology spending without being fully prepared to assess and manage risks.
- Bank regulators are paying significant attention to appropriate risk management of new technology. This will be a growing area of importance that will require greater resources from banks and banking regulators.

The gains from technological advancements in banking and payments are likely to be substantial, both from the point of view of individual financial institutions and economy-wide. In this environment, it is essential that banks review and, if necessary, adjust their risk management practices in tandem with upgrading their technology activities.

¹⁸ See, e.g., Office of the Comptroller of the Currency (1998a) and (1998b); Federal Reserve Bank of New York (1997); Federal Deposit Insurance Corporation (1997); and Office of Thrift Supervision (1997).

¹⁹ Basle Committee on Banking Supervision (1998).

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Special Studies on Technology and Banking

Banking over the Internet

by Kori L. Eglund, Karen Furst, Daniel E. Nolle, and Douglas Robertson¹

Banking over the Internet is attracting a great deal of attention in the banking and regulatory communities, and developments in this new delivery channel are the subject of numerous articles in the banking press. Despite widespread interest in and concerns about this subject, there is little systematic information on how many banks offer personal computer (PC) banking over the Internet, and on the nature of the services offered. To address this deficiency, the Special Studies staff at the Office of the Comptroller of the Currency (OCC) has undertaken a comprehensive review of Web sites of banks offering transactional Internet banking. We define "transactional" Internet banking as providing customers the ability to access their accounts and, at a minimum, transfer funds between accounts. This report provides new and unique information on the dimensions of transactional Internet banking, both in the commercial banking industry in total and for national banks.

Our key findings are as follows:

- Very few banks offered customers the ability to access their accounts and perform at least simple money transactions. As of June 30, 1998, less than 5 percent of commercial banks and less than 7 percent of national banks had such transactional Web sites. While some Internet-based financial services, particularly discount brokerage, are having a dramatic impact on the market, Internet banking at this point is a relatively small factor in the banking industry.
- Because of the relatively high number of large banks offering Internet banking, Internet-accessible banks account for almost 40 percent of commercial bank and over 60 percent of national bank assets.
- Large banks are more likely to offer transactional Internet banking than smaller banks, but some small and mid-size banks also offer customers the ability to bank via the Internet. Currently, the fixed costs of offering Internet banking do not appear to be prohibitive for small institutions.
- Banks offering transactional banking over the Internet appear to be more likely to include a privacy statement on their Web sites as compared to banks with Web sites and no transactional capabilities. The

majority of large banks have adopted Web site privacy statements. While there has been growth in adoption, most small and mid-size banks with transactional Internet banking do not yet have on-line privacy statements. Our analysis does not assess the quality of the on-line privacy information offered.

- During 1998, we estimate that the number of commercial bank transactional Web sites more than tripled, although the growth rate slowed in the second half of the year. Announcements by third-party Internet software vendors of new contracts with banks suggest that strong growth is likely in the number of transactional Web sites in early 1999.
- While use of the Internet for banking transactions is relatively small, the projected growth in Web sites means that a very large share of all banking customers will have access to this service. The critical factor for future use will be the development of products that provide higher value relative to traditional channels, and that provide adequate security, privacy, and other consumer protections. The introduction this year of electronic bill presentation may generate a substantial boost to customer usage of Internet banking.

Key Characteristics of Banks Offering Transactional Internet Banking

Advancements in information technology have made it possible for banks to use the Internet as a delivery channel for banking services. By using the Internet, as compared to previously available "proprietary" or "dial-up" PC banking, banks have the potential to reach a large number of customers at a low incremental cost. Proprietary PC banking has been used by some banks for more than two decades, but despite claims about its potential to revolutionize the delivery of banking services, its use has never become extensive.²

² Both proprietary PC banking and Internet PC banking are two forms of "remote" banking. Telephone call centers and automated teller machines (ATMs) are two other widely used forms of remote banking. Though it is not yet standard procedure in the banking press, industry studies, and common usage to specify which form of PC banking one means, it is worthwhile making the distinction between the two. They are different from a technological point of view. For example, although not yet widespread, devices other than PCs could be used for Internet banking such as "palmtop" (or hand-held) personal computers, kiosks, and Web television. It is also likely that there are differences in the levels and types of risk exposures related to these forms of remote and PC banking.

¹ The authors thank Cindi Bonnette for her generous help and Tanya Lee and Mark Ferrandino for their excellent research assistance.

Table 1—Banks offering transactional banking via the Internet¹
(as of June 30, 1998)

	All banks	National banks
Transactional Web sites for commercial banks and banking companies	223	88
Banks offering transactional Internet banking ²	374	161
Banks offering both transactional Internet banking and proprietary PC banking	68	32
Banks with transactional Internet banking as a percent of all banks, by charter type	4.2	6.3
Assets in banks with transactional Internet banking as a percent of all bank assets, by charter type	39.6	61.0

Memorandum: There were 8,983 commercial banks and 2,546 national banks as of June 30, 1998.

Source: Office of the Comptroller of the Currency using information from banks' Web sites and from FFIEC *Reports of Condition and Income*.

Notes:

¹ "Transactional" Internet banking includes any of the following activities: access accounts for balance inquiry and account history; transfer funds between accounts; electronic bill payment; download data to software; open an account; apply for a loan; apply for a line of credit; purchase financial instruments (e.g., certificates of deposit, mutual funds); purchase insurance.

² The number of banks offering transactional Internet banking is greater than the number of transactional Web sites, because the bank subsidiaries of some banking companies are accessible from a single Web site.

There are a number of reasons to believe that there is great potential for Internet banking despite the lackluster experience of proprietary systems. In recent years, we have seen the development of an electronic and communications infrastructure that could facilitate the adoption of Internet banking. The most important factor is the astounding growth in the Internet. According to one survey, the number of Internet users over the age of 16 increased from 58 million at the third quarter of 1997 to 79 million at the end of the second quarter of 1998.³ Perhaps more importantly, a recent study indicates that 40 percent of Internet users are willing to conduct a financial transaction on-line.⁴ In addition, innovations in technology hold great promise for improving the quality and functionality of on-line services. Moreover, the openness of the Internet allows banks to avoid the problems associated with the distribution of software and updates that are found in proprietary PC banking.

Our Database

Our information on the nature and extent of transactional Internet banking comes from our review of Web sites for the entire banking and thrift industries. We found almost

1,800 banking and thrift Web sites as of June 30, 1998, of which 258 were transactional, the rest being information-only sites. Of the 258 transactional Web sites, 223 belonged to individual commercial banks or multi-bank holding companies, as Table 1 shows. The Web sites of some multi-bank holding companies are used by more than one bank in the holding company, and we ascertained that the 223 banking Web sites covered 374 commercial banks.⁵ We scrutinized each transactional Web site to determine the range of services each offered. On a bank-by-bank basis we matched our Internet banking data with the OCC's database of standard banking variables. The result is a unique set of information that allows us to describe the structure and performance of banks offering transactional Internet banking, and to compare these technological "early-adopter" banks with the remainder of the banking industry.

Few Banks Offer Transactional Internet Banking

Very few banks offer transactional Internet banking. Table 1 shows that 4.2 percent of the 8,983 commercial banks offered transactional Internet banking as of June 30, 1998. National banks were slightly more likely to offer transactional Internet banking than state banks; even so, only 6.3 percent of national banks did. Nevertheless, Table 1 also shows that the small group of banks offering transactional Internet banking accounted for almost 40 percent of all commercial bank assets. Transactional Internet banks with a national charter accounted for 61 percent of national banking system assets.

Producing a comprehensive "count" of proprietary PC banking is another story. Because banks are not required to report the fact that they offer proprietary PC banking and because there is no publicly available information on all proprietary PC banking, our count is based on data we could collect from Web sites. As Table 1 shows, we were able to ascertain that 68 of the 374 banks offering transactional Internet banking also offered proprietary banking; 32 of the banks offering both Internet and proprietary PC banking were national banks.

³ The CommerceNet/Nielsen Internet Demographic Survey of North American Internet users over the age of 16.

⁴ As reported by Piper Jaffray Research, *Online Brokerage*, October 1998, using data from GVU Internet surveys 1995–1998.

⁵ In so doing, we took a fairly conservative approach, including multiple subsidiary banks only if a given Web site contained a statement that it was applicable to multiple banks, or if it contained other information strongly indicating this. As a consequence, our bank "count" may somewhat understate the total number of banks covered by the 223 Web sites.

Table 2—Banks offering transactional PC banking via the Internet: size distribution
(as of June 30, 1998)

Asset size	Number of banks	Percent of all banks	Number of national banks	Percent of all national banks
Less than \$100 million	72	1.3	26	2.0
\$100 million to \$1 billion	210	7.1	74	7.2
\$1 billion to \$10 billion	65	21.0	40	27.2
Greater than \$10 billion	27	42.2	21	52.5

Memorandum:

National banks as a percent of all banks: 28.3

National banks offering transactional Internet banking as a percent of all banks offering transactional Internet banking: 43

Source: Office of the Comptroller of the Currency using information from banks' Web sites and FFIEC *Reports of Condition and Income*.

Table 3—Structure characteristics of banks offering transactional banking via the Internet
(as of June 30, 1998)

	Banks with transactional Internet banking	Banks without transactional Internet banking
Number of banks	374	8,609
Structure characteristics (averages)		
Assets (in millions)	\$5,481	\$364
Deposits (in millions)	\$3,711	\$246
Number of branches	61	5
Number of employees	1,676	112

Source: Office of the Comptroller of the Currency using information from banks' Web sites and from FFIEC *Reports of Condition and Income*.

Banks Offering Transactional Internet Banking Are Larger on Average than Other Banks

The different impressions one gets from considering the small number of transactional Internet banks on the one hand, and the large proportion of banking system assets for which these banks account on the other hand, is explained by the fact that a relatively high proportion of large banks offered this delivery channel, when compared with the proportion of large banks in the whole banking industry. Table 2 shows that 27 large banks, accounting for 42 percent of all commercial banks in the over-\$10-billion-in-assets size category, offered transactional Internet banking; 21 of these were national banks. By comparison, the 72 small banks offering transactional Internet banking accounted for only 1.3 percent of all banks in the under-\$100-million-in-assets size category.

Measured by assets or deposits, transactional Internet banks as a group were about 15 times larger on average than the 8,609 banks which did not offer transactional Internet banking, as Table 3 indicates. The size differential is apparent in the comparison of the average number of branches and employees per banks as well. However, 75 percent of the transactional Internet banks were under \$1 billion in assets, indicating that the cost of offering Internet banking is not prohibitive for small banks.

We also compared the performance of transactional Internet banks with other banks in order to ascertain if there are distinct characteristics of these early adopters. We did not find obvious differences between the groups in profitabil-

ity, efficiency, or credit quality.⁶ The relative similarity of the performance of the two groups held across size categories, leading us to the conclusion that transactional Internet banks differ from other banks primarily by size.

Key Internet Banking Characteristics

Virtually all banks with transactional Internet banking offered customers the ability to check their account balances and history, and transfer moneys between their accounts, as Table 4 shows.⁷ Three-fourths of banks with transactional Internet capabilities offered customers an electronic bill payment service; almost 80 percent of national banks with transactional Internet banking offered

⁶ Anecdotal evidence suggests that most bankers do not believe they are receiving a significant boost to net revenue from their customers' use of Internet banking capabilities. We did not conduct any formal statistical analysis to ascertain if offering Internet banking may be a factor in determining bank performance. Such analysis is likely to be more fruitful as the use of Internet banking spreads and matures.

⁷ A small number of Web sites did not contain information about one or more of the attributes displayed in Table 4. In building our data set we took a conservative approach, inserting "missing values" into these fields. Subsequently, we calculated the percentages in Table 4 using as the denominator 374, the total number of banks offering transactional Internet banking, rather than excluding the missing values (which varied across attributes) from the denominator, and then calculating percentages. This approach makes very little quantitative difference and no qualitative difference in the results displayed in Table 4, though it seems highly likely that in fact 100 percent of banks offering transactional Internet banking offer at least balance inquiry and funds transfer.

Table 4—Banks offering transactional banking via the Internet: key services
(as of June 30, 1998)

Type of service offered	Services offered (percent of transactional Internet banks) ¹	
	All banks	National banks
Balance inquiry and funds transfer	98.1	98.1
Electronic bill payment	75.4	80.7
Business Internet banking	24.1	39.1
Open an account	19.5	24.8
Apply for loan	12.8	17.4
Transactional Internet banking and proprietary PC banking	18.2	19.9

Source: Office of the Comptroller of the Currency using information from banks' Web sites.

Notes:

¹ For a small number of institutions it was not possible to ascertain the nature of the Internet banking services offered. For purposes of the calculations in this table, missing values were treated as if the service was not offered.

this service (Table 4). Electronic bill payment allows the bank's customers to instruct the bank to make payments electronically. The bank then either sends an automated clearing house (ACH) payment or a paper check. In either case, the customer's account is debited for the amount of the payment. Customer use of electronic bill payment is not yet widespread, but many observers believe there is likely to be a sudden, large increase in customer demand for this technology. Electronic bill presentment, due to be offered by a number of banks early in 1999, has the potential, in combination with electronic bill payment, to "electronify" the entire billing and payment process.⁸

Although transactional Internet banking is commonly viewed as a service offered to individuals, among banks offering transactional Internet banking, a sizeable minority offered an Internet-based service tailored to businesses. Table 4 shows that almost a quarter of commercial banks with transactional Internet Web sites, and almost 40 percent of national banks, offered transactional Internet services aimed at business customers. Some industry observers believe that access to Internet banking services is likely to become increasingly important to small and medium-size businesses. We know of no precise analysis measuring the demand for such a service by businesses, but some observers suggest that, in general, both small and large banks have stepped up efforts to gain more small- and medium-size-business customers.

Table 4 shows that fewer than 20 percent of banks' transactional Web sites allowed customers and potential

customers to open an account on-line. Even fewer had provisions for applying for a loan on-line. These lower percentages may in part be due to uncertainty about the validity of alternatives to handwritten signatures. It is unclear how the use and acceptance of electronic authentication will affect these activities, particularly the ability to open an account on-line, and a banks' ability to know a customer on-line without in-person identification.

Privacy Statements and Transactional Internet Banking

Technological developments have introduced tremendous changes in the ability of financial and nonfinancial firms to efficiently collect, store, use, and sell information about their customers. This has heightened concerns about the potential for violations of personal privacy. In a report to Congress this past summer, the Federal Trade Commission (FTC) stated that industry efforts to encourage voluntary adoption of the most basic privacy protection—notice⁹—have fallen short of what is needed to protect consumers. The FTC conducted an on-line survey in March of 1998 and found that only 14 percent of all Web sites and 17 percent of financial Web sites posted a notice describing the collection and use of information.¹⁰

Our analysis of transactional bank Internet Web sites provides additional information on the extent of on-line privacy statements. As displayed in Table 5a, in June 1998 slightly over 40 percent of all transactional banking Web sites included a privacy statement that at a minimum indicated what information is collected by the bank on-line, and how it is to be used. The corresponding percentage for national bank transactional Web sites was slightly higher at 41 percent. It is important to note that we have

⁸ This point is explored further in Furst, Karen, Daniel E. Nolle, and William W. Lang, "Technological Innovation in Banking and Payments: Industry Trends and Implications for Banks," *Quarterly Journal*, Vol. 17, No. 3, Office of the Comptroller of the Currency, September 1998; and in Radecki, Lawrence J., and John Wenninger, "Paying Electronic Bills Electronically," *Current Issues in Economics and Finance*, Vol. 5, No. 1, Federal Reserve Bank of New York, January 1999. For a recent description of the perspectives of current and possible future participants in the market for electronic bill presentment and payment, see O'Sullivan, Orla, "Banks Begin to Present Bills On Line," *USBanker*, Vol. 108, No. 12, December 1998, pp. 64–70.

⁹ Notice includes telling customers what information is to be collected about them, and the intended use of that information.

¹⁰ The FTC sample included 125 Web sites of banks, credit unions, mortgage companies, real estate firms, security and stock brokerage, and other financial services firms.

Table 5a—Privacy statements and transactional Internet banking¹

	June 30, 1998		November 30, 1998		Percent increase in privacy coverage	
	All banks	National banks	All banks	National banks	All banks	National banks
Percent of transactional Web sites with on-line privacy statement	40.4	40.9	51.6	54.5	27.8	33.3

Table 5b—Transactional Web sites with on-line privacy statement as a percent of all transactional Web sites, by asset size category

Asset size	June 30, 1998		November 30, 1998	
	All banks	National banks	All banks	National banks
Less than \$100 million	30.4	21.4	37.0	35.7
\$100 million to \$1 billion	37.4	32.6	48.9	41.3
\$1 billion to \$10 billion	36.4	37.5	52.6	62.5
Greater than \$10 billion	74.1	75.0	88.9	95.0

Source: Office of the Comptroller of the Currency using information from banks' Web sites.

Notes:

¹ To qualify as having a privacy statement, a Web site had to indicate what information is collected and how it is used.

made no qualitative assessment of these on-line privacy statements, which may vary widely in the nature of the information they provide to customers.

We examined these same sites for privacy statements as of November 30, 1998. Over that five-month period, the percentage of sites with on-line privacy statements grew to almost 52 percent, an increase of almost 28 percent. The growth at national bank Web sites was somewhat higher at 33 percent.

A distinct pattern emerges when we look at privacy statements for banks of different sizes. Table 5b reveals that large banks are much more likely to have an on-line privacy statement. In June 1998, three-fourths of banks with greater than \$10 billion in assets had on-line privacy statements, and by November 30 this had increased to almost 90 percent. The corresponding level was even higher for large national banks with transactional Internet banking: 95 percent of national banks with greater than \$10 billion in assets included privacy statements on their transactional Web sites.

Among the largest 10 banks, six offered transactional Internet banking in June 1998, but one of those banks did not have an on-line privacy statement, a situation that was remedied by the time we re-examined Web sites at the end of November. By that time, seven of the top 10 banks had transactional Internet banking Web sites, and all of these had on-line privacy statements. In addition, for the three without transactional Web sites, one had an on-line privacy statement on its non-transactional Web site.

Small banks, particularly those in the smallest size category with less than \$100 million in assets, were much less likely to have on-line privacy statements. In June 1998, only 30 percent of Web sites for this group of banks included a privacy statement. Coverage increased to 37 percent by November. These figures show that despite

progress in addressing on-line privacy, the majority of small banks still do not have an on-line privacy statement.

Growth of Transactional Internet Banking

Data of the same scope and quality as our data for transactional Internet banking as of midyear 1998 do not exist for other points in time, so it is not possible to describe with precision the growth of transactional Internet banking. However, based on information from the Federal Deposit Insurance Corporation (FDIC), from a widely used industry publication, and from recent press reports, it is possible to estimate roughly the recent growth trend in banks offering transactional Internet banking.

Some observers have said that the transactional Internet banking "era" is approximately three years old.¹¹ Figure 1 shows that by year-end 1997 (i.e., at the end of the second year of the Internet banking era) there were only 103 transactional banking and thrift Web sites.¹² However, the number of transactional banking Web sites increased to 258 over the first six months of 1998, an annual growth rate of over 300 percent. Our estimates of the number of transactional banking and thrift Web sites for the end of the third quarter and the end of November of 1998 indicate a slowdown in that pace, but still show steady growth.

There are indications that growth in the number of transactional Web sites will accelerate in early 1999. In late 1998 and early 1999, we reviewed numerous Web sites and press releases of major vendors announcing

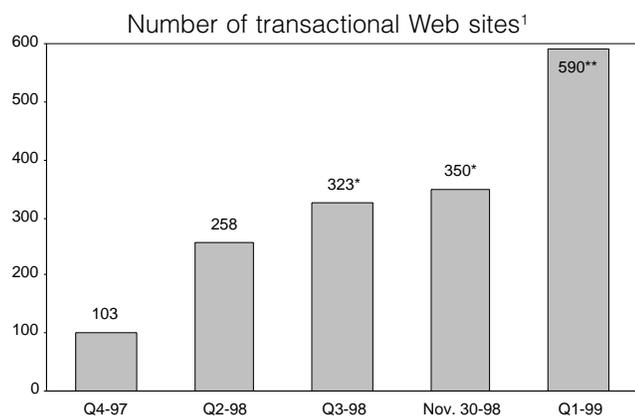
¹¹ For example, see the article in *The Charlotte Observer*, October 24, 1998.

¹² The few other "counts" of Internet banking that exist do not distinguish between banks and thrifts. Though most of this report deals with commercial bank Web sites, we compiled information on thrift Web sites as well, and so are able to put our figures for June 30, 1998 on the same basis as other data bases we have used.

new contracts with banks and thrifts to build and/or service Web sites.¹³ Based on this information, we calculate that at least 240 new bank and thrift transactional Web sites will come on-line within the next several months, bringing total transactional bank and thrift Web sites to 590 by the end of the first quarter of this year, as displayed in Figure 1. At a pace of 240 new Web sites per quarter, there would be about 1,300 transactional bank and thrift Web sites by the end of 1999, covering perhaps 10 to 15 percent of all commercial banks.¹⁴

It is more difficult to gauge the extent and growth of customer usage of transactional Internet banking. Industry estimates vary widely and generally lack precision, but most estimates suggest that usage is not widespread. Based on a recent estimate of "on-line" banking usage, roughly 4 percent of households currently bank on-line.¹⁵ However, the 374 commercial banks currently offering Internet banking account for 41 percent of all small deposits at commercial banks. Even without taking into account the likely growth in Internet banking Web

Figure 1—Transactional Internet banking Web sites: strong growth in 1998, possible surge in early 1999



¹ Bank and thrift Web sites

* estimated

** extrapolated

Source: Office of the Comptroller of Currency using data from the FDIC, bank and thrift Web sites, *On-line Banking Report*, and selected vendor Web sites and press releases.

¹³ Based on our conversations with several vendors, we estimate that over 90 percent of the new Web sites will be transactional.

¹⁴ Our intent is to determine what sort of "baseline" growth rate results from extrapolating from known information, rather than to attempt to forecast future growth in transactional Internet banking. We also caution that our baseline may be somewhat conservative. It is possible, for example, that as banks complete their Y2K readiness programs during 1999 they may be able to focus more resources on technology upgrades, including transactional Internet banking. In addition, it is worth mentioning that many of the 1,500 or so banks that had an Internet site without transactional capabilities at mid-year 1998 may have viewed establishing an Internet presence as a prerequisite to offering transactional banking in 1999. If so, past growth rates are likely to understate this sort of "evolutionary" move to transactional Internet banking.

¹⁵ PSI Global, as illustrated in "Delivering the Goods," special section of the *American Banker*, December 1, 1998.

sites, the infrastructure already in place provides considerable potential for expansion in Internet banking activity.

It is impossible to predict whether such expansion in usage will occur, but the possibility should not be discounted. Such dramatic shifts in market acceptance are not unusual in the world of electronic commerce. For example, starting from virtually zero three years ago, on-line brokerage activity now accounts for almost one quarter of all individual brokerage activity.¹⁶ Moreover, bill presentment is expected to become operational during 1999. Many industry experts believe that the introduction of bill presentment could greatly accelerate the already rapid growth in the use of bill payment through on-line banking.

Summary and Conclusions

Few banks offer transactional Internet banking, though the relatively high proportion of large banks in this group means that a significant share of industry assets and deposits are accounted for by these banks. The significant number of small and mid-size banks offering Internet banking suggests that the fixed costs of offering Internet banking do not appear to be prohibitive for small institutions. In terms of performance characteristics, we found no evidence of major differences in the performance of the group of banks offering transactional Internet banking compared to those that do not.¹⁷

The majority of large banks are adopting Web site privacy statements. While there has been growth in adoption, most small and mid-size banks with transactional Internet banking do not yet have on-line privacy statements. We did not assess the quality of the on-line privacy information offered.

Growth in the number of banks offering transactional Internet banking has been strong recently. However, even if recent growth trends accelerate somewhat, that would still result in a relatively small percentage of banks offering transactional Internet banking by the end of 1999. Nevertheless, it is likely that the majority of large banks will offer transactional Internet banking by the end of 1999.

Usage of Internet banking is still a relatively small factor in the banking industry. However, it is likely that over half of existing depositors will have deposit accounts at banks with Internet banking sites by the end of 1999. A change in consumer demand for Internet banking services could potentially generate a rapid expansion in the importance of Internet banking activity for the industry. Such shifts in customer preferences may become a hallmark in the world of electronic commerce.

¹⁶ Calculations based on Deutsche Bank Research and Piper Jaffray Equity Research.

¹⁷ Our external approach to the data does not allow us to make any judgments about transactional risk exposure, including security risk.