Internet Banking: Developments and Prospects

Karen Furst, William W. Lang, and Daniel E. Nolle

Economic and Policy Analysis Working Paper 2000-9

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Abstract: This paper addresses significant gaps in existing knowledge about the Internet banking landscape. Using information drawn from a survey of national bank examiners, we find that while only 20 percent of national banks offered Internet banking in Q3 1999, these transactional Internet banks accounted for almost 90 percent of national banking system assets and 84 percent of the total number of small deposit accounts. All of the largest national banks offered Internet banking, but only about 7 percent of the smallest banks offered it. Among institutions offering Internet banking, large banks are more likely than small banks to offer a broad range of services on the Internet. Matching call report data to the examiner survey information, we also find that banks in all size categories offering Internet banking tend to rely less on interest-yielding activities and deposits than do non-Internet banks, and institutions with Internet banking outperformed non-Internet banks in terms of profitability. Excepted from the superior performance of Internet banks versus non-Internet banks are *de novo* Internet banks, which were less profitable and less efficient than non-Internet *de novos*. Projections based on banks' plans as of Q3 1999 indicate that 45 percent of all national banks will be offering Internet banking by the beginning of 2001. While most of the growth in new Internet banking will be due to small banks coming online, almost half of all national banks had no plans to offer Internet banking. Large banks have more aggressive plans to offer business Internet banking services in the future than small institutions.

We develop logit models to explain why banks choose to adopt Internet banking, and why some choose to offer a relatively wider array of Internet banking products and services. Among the key factors explaining which banks have chosen to offer Internet banking are membership in a bank holding company, physical location of the bank in an urban area, relatively higher premises and other fixed expenses to net operating revenue, and higher noninterest income, and efficiency than non-Internet banks. More profitable banks were more likely to adopt Internet banking after Q2 1998, but more profitable institutions were less likely to be among the "first movers" - i.e. banks adopting Internet banking as of Q2 1998. Among banks that offer Internet banking, larger banks and banks that offered the service for a longer time were significantly more likely to offer a wider range of services on the Internet.

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I. Introduction

Banking over the Internet has attracted increasing attention from bankers and other financial services industry participants, the business press, regulators, and law makers, both in the United States and other countries. Among the reasons for Internet banking's audience are the notion that electronic banking and payments will grow rapidly, more or less in tandem with proliferating electronic commerce; industry projections that Internet banking will cut banks' costs, increase banks' revenue growth, and make banking more convenient for customers; and some vexing public policy issues. Despite this attention, there is a dearth of systematic information on the nature and scope of Internet banking. Bankers and public policymakers alike have had to plan using largely anecdotal evidence and conjecture.

The main purpose of this paper is to help fill significant gaps in existing knowledge about the Internet banking landscape. We use the term "Internet bank" to mean a bank offering its customers the ability to transact business with the bank over the Internet.[1] Using information drawn from a survey of national bank examiners, we present data on the number of national banks offering Internet banking and the products and services being offered. We also use the survey's results to project how much Internet banking will have grown by the beginning of 2001. In addition, using univariate statistical analysis, we investigate the profile of national banks offering Internet banking relative to other national banks with respect to profitability, cost efficiency, and other characteristics. We separately examine *de novo* national banks to investigate the extent to which new entrants are embracing Internet banking technology to a different degree than existing banks. We then develop and test empirical models explain why

[1] We do not confine the term to Internet-only or "virtual" banks. Customer transactions on the Internet can be as simple as online balance inquiry or credit application, but can also include such services as electronic bill presentment, insurance, and brokerage. "Non-Internet banks" refer to banks that do not offer transactional Internet banking, even if they have a Web site.

banks choose to adopt Internet banking, and why some choose to offer a relatively wider array of Internet banking products and services.

Our main findings are:

- Only 20 percent of national banks offered Internet banking in Q3 1999. However, as a group, these "Internet banks" accounted for almost 90 percent of national banking system assets and 84 percent of the total number of small deposit accounts.

- All of the largest national banks offered Internet banking, but only about 7 percent of the smallest banks offered it. Among institutions offering Internet banking, large banks are more likely than small banks to offer a broad range of services on the Internet.

- Banks in all size categories offering Internet banking tend to rely less on interest-yielding activities and deposits than do non-Internet banks.

- Institutions with Internet banking outperformed non-Internet banks in terms of profitability. It is likely that the more aggressive business posture of these banks explains both their relatively higher profitability and their decision to offer Internet banking.

- Excepted from the superior performance of Internet banks versus non-Internet banks are *de novo* Internet banks. Such *de novos* were less profitable and less efficient than non-Internet *de novos*.

- Among the key bank characteristics explaining which banks have chosen to offer Internet banking are membership in a bank holding company, physical location of the bank in an urban area, relatively higher premises and other fixed expenses to net operating revenue, and higher noninterest income, and efficiency than non-Internet banks. More profitable banks were more likely to adopt Internet banking after Q2 1998, but more profitable institutions were less likely to be among the "first movers" - i.e. banks adopting Internet banking as of Q2 1998.

- Among banks that offer Internet banking, larger banks and banks that offered the service for a longer time were significantly more likely to offer a wider range of services on the Internet. Large banks have more aggressive plans to offer business Internet banking services in the future than small institutions.

- Projections based on banks' plans as of Q3 1999 indicate that 45 percent of all national banks will be offering Internet banking by the beginning of 2001. Those banks will account for 95 percent of the assets and 93 percent of the small deposit accounts at national banks.

- While most of the growth in new Internet banking will be due to small banks coming online, almost half of all national banks had no plans to offer Internet banking. The large majority of those are small institutions.

- Customer use of Internet banking is disproportionately concentrated among a few large banks. Based on analysis of data from private sector studies, we estimate that the five banks with the greatest number of online customers account for almost 36 percent of all Internet banking users. By comparison, these same five banks account for only 20 percent of small deposit accounts.

Section II of this paper defines Internet banking and provides context for our analysis. Section III describes our database and specifies the number and size distribution of national banks offering Internet banking. That section also outlines the nature of Internet banking products and services offered by national banks. Section IV compares the structure and performance of banks offering Internet banking with other banks. Section V develops and tests logit models of factors explaining why banks offer Internet banking, as well as factors explaining which Internet banks offer a wide range of Internet banking services. Section VI projects how much Internet banking will have grown by the beginning of 2001 based on the stated plans of national banks. That section also discusses current and potential future demand for Internet banking using bank and industry estimates of customer use. The concluding section summarizes our major findings.

II. Internet banking: definitions and background

Internet banking refers to the use of the Internet as a remote delivery channel for banking services. Such services include traditional ones, such as opening a deposit account or transferring funds among different accounts, and new banking services, such as electronic bill presentment and payment (allowing customers to receive and pay bills on a bank's Web site).

Banks offer Internet banking in two main ways. An existing bank with physical offices can establish a Web site and offer Internet banking to its customers as an addition to its traditional delivery channels. A second alternative is to establish a "virtual," "branchless," or "Internet-only" bank. The computer server that lies at the heart of a virtual bank may be housed

in an office that serves as the legal address of such a bank, or at some other location. Virtual banks may offer their customers the ability to make deposits and withdraw funds via ATMs or other remote delivery channels owned by other institutions.

To date, it has been difficult to assemble comprehensive information on the Internet banking activities of commercial banks in the United States. This is because there are no special reporting requirements for Internet banks, and hence there is no regularly compiled set of data about banks' Internet activity.[2] Although two recent studies have estimated the number of banks offering Internet banking and described some of these banks' characteristics, the studies relied on sampling methods for a banking industry profile rather than an actual count of banks.[3] To our knowledge, prior to the current study, only Egland, Furst, Nolle, and Robertson (1998) provide both an actual count of banks offering Internet banking and an analysis of major structure and performance characteristics of these banks.[4]

With this in mind, Figure 1 approximates the "supply" of Internet banking from the end of 1997 through the end of 1999. During that time, according to estimates by the FDIC, as well as Couch and Parker (2000), the number of banks and thrifts with Web sites more than doubled from approximately 1500 to 3500; by year-end 1999, approximately one-third of the 10,000 U.S.

[2] Banks are also not required to report information about other delivery channels, such as ATMs and telephone banking. Note that beginning in 1999 the OTS has required prior notice for federally chartered thrifts, and in the third quarter of 1999 a line was added to the call report for all banks and thrifts to report their URL.

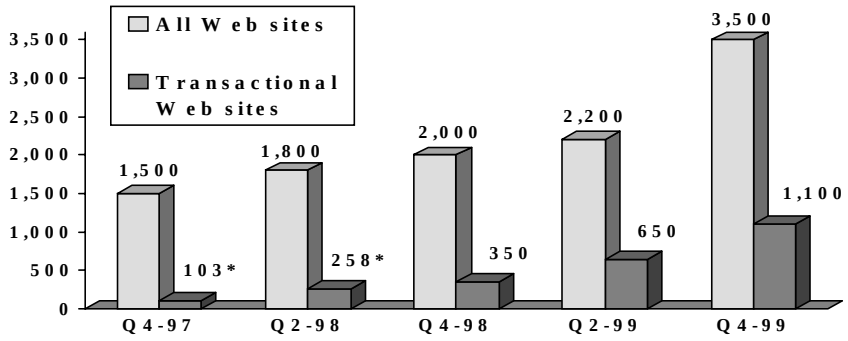
[3] See United States General Accounting Office (1998) and the Board of Governors of the Federal Reserve System, Federal Deposit Insurance Corporation, Office of the Comptroller of the Currency, and the Office of Thrift Supervision (1999) (henceforth referred to as the "Interagency Web Site Privacy Report").

[4] As Egland, Furst, Nolle, and Roberston (1998) explain, there is an element of estimation even in that study. This is because a single Web site may cover more than one bank that is a member of a multibank holding company. As a consequence, the authors distinguish between the number of Web sites and banks covered by those Web sites. See Egland, Furst, Nolle, and Robertson (1998), footnote 5.

banks and thrifts had Web sites. Approximately 1,100 of those Web sites were transactional, i.e., they allowed customers to conduct business online. The remainder were information-only sites.[5]

While "virtual banks" have generated considerable attention in the press and within the banking industry, at the beginning of 2000 only nine separately chartered banks were Internet-only. Virtual banks can be established in several ways. New investors in the banking industry obtain charters from state or federal supervisory authorities to establish new, independent virtual banks. Alternatively, existing banking companies create virtual banks as separately capitalized subsidiary banks of a bank holding company. A third route that is beginning to be pursued by investors is to purchase the existing charter of a traditional bank, and then to recast the bank as a virtual bank under the existing charter.

Figure 1— Estimated bank and thrift Web sites, and transactional Internet banking Web sites



*Actual.
Source: Office of the Comptroller of the Currency using data from the FDIC, Couch and Parker (2000), and bank and thrift Web sites

[5] In Q2 1998, Egland, Furst, Nolle and Robertson (1998) found that 223 Web sites represented 374 banks. Extrapolating from this ratio of 1.68 banks-per-banking company Web site, 18 percent of banks and thrifts offered true Internet banking as 2000 began.

As an alternative to seeking a separate charter for an Internet-only bank, "trade-name" Internet banks have been established as separate divisions of an existing bank.[6] At the beginning of 2000, there were roughly twenty trade-name virtual "banks" in the United States. A trade-name virtual bank typically operates independent of the rest of the bank in terms of staffing, marketing, and integration of computer systems into the existing bank's legacy systems. This corporate strategy arises out of the desires to capture the perceived advantages of a virtual bank's operating style, and to project a fresh image that will attract new customers. But both trade-name and separately chartered virtual banks may find it difficult to attract and retain customers unless they give the bank some physical presence such as kiosks or limited service offices.[7] Such a "clicks and bricks" approach could emerge as a popular way of offering Internet banking.[8]

III. Internet banking in the national banking system

The data set

The data set for the current study is unique in a number of respects. First, it covers the Internet banking offerings of every national bank. That information was compiled based on responses to a questionnaire OCC examiners completed between mid-August and mid-

[6] For business press accounts of Internet-only banks, including trade-name banks such as WingSpanBank.com, see Hallerman (1999a), Costanzo and Senior (1999), Daudelin (2000), Financial Service Online (2000), Giesen (2000), and O'Sullivan (2000 a and b).

[7] See O'Sullivan (2000b) and Costanzo (2000) for discussions of the difficulties virtual banks face in the marketplace. O'Sullivan (2000b) reports on research evaluating the performance of virtual banks relative to traditional banks offering Internet banking. See also *Bank Technology News* (2000), which compares studies by CheckFree Corp. and GartnerGroup showing that consumers wishing to engage in electronic billing have a significantly stronger preference for dealing with a bank with a physical presence rather than an Internet-only bank. See also Financial Service Online (1999), *Bank Network News* (2000), Day (2000), and Toonkel (2000b) on this issue.

[8] The strategy of moving away from an Internet-only strategy is receiving attention in businesses besides banking. See, for example, McIntyre and Christensen (1999), and Hamilton (2000).

September 1999 for 2,535 national banks. The questionnaire covered whether a bank had a Web site and, if so, whether the Web site was transactional. For banks with transactional sites, examiners provided a more detailed set of information on the nature of their sites, including information on the range of products offered. Examiners also answered questions about banks' plans for offering Internet banking in the future.

We matched the examiner-response data with financial data for the 2,517 national banks that filed a third quarter 1999 Report of Condition and Income (the "call report"), and we added banking structure data from the OCC's Integrated Banking Information System database. In addition, we included supervisory information on banks' CAMELS ratings, as well as on their information technology (IT) practices. While our data set is confined to national banks, we believe it is broadly applicable to the banking system at large.[9]

Number and size distribution of Internet national banks

Based on daily articles in the business press, one might easily conclude that most banks offer Internet banking.[10] In fact, as Table 1 shows, while slightly more than half of all national banks had Web sites in the third quarter of 1999, only 464 national banks — just under 20 percent of all FDIC-insured national banks — offered transactional Internet banking to their customers.[11]

[9] As of the third quarter of 1999, national banks accounted for 28 percent of all banks and 59 percent of all banking system assets. On average, national banks are larger than state banks. But national banks are widely distributed across asset size categories, and they exhibit the same performance characteristics as state banks of like size. Egland, Furst, Nolle, and Robertson (1998) found no evidence of significant differences in the structural attributes of national and state banks offering Internet banking.

[10] For example, during the week of March 20, 40 percent of the articles in the *American Banker* dealt with Internet banking.

[11] As noted at the bottom of Table 1, this figure excludes credit card banks.

Table 1. Internet banking and national banks
(Q3 1999)

	Number	Percent of national banks
National banks with Web sites	**1364**	**54.2**
National banks with transactional Web sites	**541**	**21.5**
of which:		
FDIC-insured commercial national banks with transactional Web sites[a]	**464**	**19.9[b]**
of which:		
Virtual banks[c]	**1**	[d]

Memorandum:
Total national banks[e]: 2,517
Total FDIC-insured national banks: 2,334[a]

Source: Office of the Comptroller of the Currency

[a]Excluding credit card banks.
[b]FDIC-insured commercial national banks with transactional Internet banking as a percent of all FDIC-insured national banks, excluding credit card banks.
[c]See the text for a definition of "virtual bank."
[d]Less than 1 percent.
[e]All national banks for which a Q3 1999 call report was filed.

Although only a minority of institutions offer Internet banking, banks offering these services accounted for almost 90 percent of the assets in the national banking system (Table 2). In addition, transactional Internet banks accounted for almost 85 percent of all deposit accounts under $100,000 in the national banking system. Because such deposits are a reasonably good measure of consumer accounts at banks, we can say that most consumer accounts are at banks that offer Internet banking. According to market surveys, consumers do not transact much banking business over the Internet. Our data suggest that this limited usage is primarily due to a lack of consumer demand for the current set of Internet banking products, rather than a lack of access. The infrastructure is in place to allow for very rapid growth in the use of Internet

banking if consumers can be persuaded that using the Internet is superior to traditional delivery channels.[12]

Table 2. Internet banks few in number, but dominant in key characteristics
(Q3 1999)

	Transactional Internet national banks as a percent of all national banks	
Number of banks	19.9	
Assets[a]	89.2	
Small deposit accounts[b]	84.1	
	Transactional Internet national banks	**Non-Internet national banks**[c]
Average size (assets in $ billions)	5.88	0.18
Average number of employees	1,659	69
Average number of offices per bank[d]	61	5
Average number of employees per office	27	15
Percent of banks in urban areas[e]	72.2	42.6

Source: Office of the Comptroller of the Currency.

[a] Dollar value of assets.
[b] Percent of number of deposit accounts under $100,000.
[c] Includes banks with Web sites that are not transactional.
[d] Includes headquarters, branches, and non-branch offices.
[e] "Urban area" is defined as a Standard Metropolitan Statistical Area.

As a group transactional Internet banks had, on average, 33 times more assets, 24 times more employees, and 12 times more offices than non-Internet national banks. In addition, although Internet banking can enable a remotely located bank to reach potential customers

[12] Recent analyses indicate that a large percentage of customers who sign up for Internet banking discontinue using it. See, e.g., Redman (1999), who summarizes the findings of a Cyber Dialogue study. Craig (1999) presents a theoretical analysis of the obstacles to changes in payment patterns. Also see Marks (1999), who compares the relative success of online brokerage to online banking.

anywhere, transactional Internet banks were more than one-and-a-half times more likely to be located in an urban area than were non-Internet banks.

Table 3. National banks offering transactional Internet banking: size distribution
(Q3 1999)

	Number of Internet banks	Internet banks as a percent of banks in size category	Average asset size of Internet banks relative to non-Internet banks[a]
Less than $100 million	85	7.1	0.95
$100 million to less than $1 billion	265	27.1	1.45
$1 billion to less than $10 billion	73	61.9	1.40
$10 billion and over	41	100.0	n.a.
Total	464	19.9	32.67

Source: Office of the Comptroller of the Currency

[a]Non-Internet banks include those with a Web site that is not transactional.
n.a.: not applicable.

Table 3 illustrates the size distribution of Internet and non-Internet banks. All of the largest banks (i.e., those with $10 billion or more in assets) and almost two-thirds of mid-sized banks (i.e., those with between $1 billion and $10 billion in assets) offered Internet banking. By contrast, only 7 percent of small banks (i.e., those with under $100 million in assets) did. Nevertheless, it is clear that while large banks are far more likely to be transactional, small size is not a prohibitive barrier to offering Internet banking.

The rate of growth in the number of banks adopting transactional Internet capabilities has been substantial in every size category. As Table 4 shows, between mid-1998 and the third

quarter of 1999, the number of transactional Internet banks under $1 billion in asset size more than tripled. Over that 15-month period, the percentage of national banks offering transactional Internet banking rose from 6.3 percent to 19.9 percent.

Table 4. Recent growth in Internet banking offered by national banks

	Percent of banks offering transactional Internet banking		Percent increase in number of banks offering Internet banking
Asset size	**Q2 1998**	**Q3 1999**	**Q2 1998 to Q3 1999**
All	6.3	19.9	188.2
Less than $100 million	2.0	7.1	226.9
$100 million to less than $1 billion	7.2	27.1	258.1
$1 billion to less than $10 billion	27.2	61.9	82.5
$10 billion and over	52.5	100.0	95.2

Source: Office of the Comptroller of the Currency; Egland, Furst, Nolle, and Robertson (1998).

Key Internet banking services

Egland, Furst, Nolle, and Robertson (1998) showed that in mid-1998, most transactional Internet banks offered the services of balance inquiry and funds transfer between accounts. That generalization still applied in the third quarter of 1999, as Table 5 shows, although small transactional banks were somewhat less likely to offer these services.[13] There is a more

[13] Most of the banks that did not offer balance inquiry or funds transfer at a minimum offered online credit applications.

significant divergence by size category in the proportion of banks offering electronic bill payment.[14] All of the very largest banks, and over 90 percent of banks in the $1 billion to $10 billion asset class, offer electronic bill payment. This drops to 77 percent for banks between $100 million and $1 billion, and to 60 percent for the smallest banks.

Looking at Internet banking services beyond balance inquiry, funds transfer, and bill payment, what is offered, which varies greatly, depends on a bank's size. In general, larger banks are more likely to accept credit applications online. Except for the smallest banks, there is no relationship between size and the ability to set up a new account on the Internet.

One notable feature of Table 5 is that banks of all sizes were roughly equally likely to offer online cash management services. Cash management is a key business-oriented service and the Internet would seem to offer significant opportunities for banks to create value by improving the efficiency of cash management systems. Thus, competing in this line of business may be an important determinant of how well small banks compete with larger institutions for business customers. As of the third quarter of 1999, it appeared that small banks were giving this business line as much focus as large banks. However, as Table 5 makes clear, only about 16 percent of all transactional banks offered this service, a percentage far below that for most other online products for which we collected data.[15]

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[14] Electronic bill payment allows a bank's customers to instruct the bank to make payments electronically. The bank then either sends an automated clearinghouse (ACH) payment or a paper check. In either case, the customer's account is debited for the amount of the payment.

[15] In the first quarter of 1999, Pizzani (1999) reported that "banks have largely ignored the online banking needs of small businesses." As we discuss in the section on banks' plans (below), it appears that bankers are planning to increase dramatically their emphasis on business Internet banking services.

Table 5. Key services offered by transactional Internet national banks
(Q3 1999)

Type of service	Percent of transactional Internet banks offering selected services				
	All banks	**Less than $100 million**	**$100 million to less than $1 billion**	**$1 billion to less than $10 billion**	**$10 billion and over**
Balance inquiry and funds transfer	88.8	74.1	90.2	94.5	100.0
Bill payment	78.2	60.0	77.4	90.4	100.0
Credit applications	60.0	51.8	51.7	75.3	80.5
New account set-up	36.6	29.8	43.9	45.2	43.9
Brokerage	21.6	10.6	14.7	41.1	53.7
Cash management	15.7	14.1	16.2	15.1	17.1
Fiduciary	11.9	3.5	9.8	12.3	41.5
Bill presentment	10.6	7.1	7.9	16.4	24.4
Insurance	5.4	2.4	2.3	6.8	29.3
Basic[a]	77.6	56.5	77.4	90.4	100.0
Premium[b]	23.9	14.1	17.0	41.1	58.5

Source: Office of the Comptroller of the Currency.

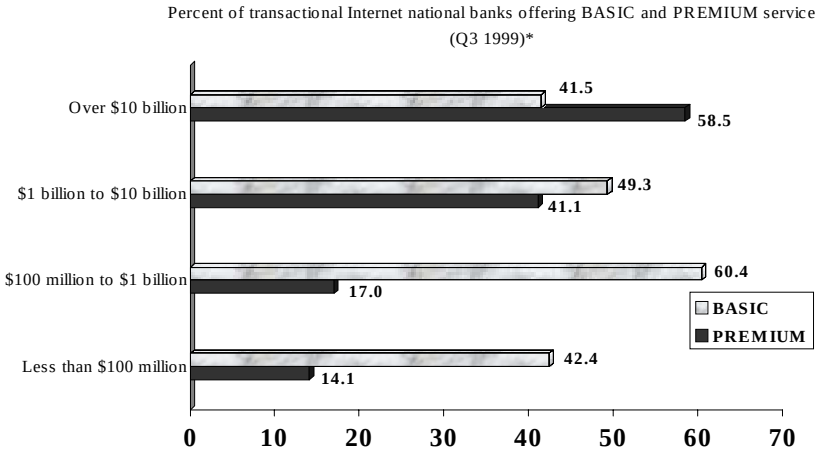
[a] "Basic" includes balance inquiry, funds transfer, and bill payment.
[b] "Premium" includes "Basic" and at least three other services.

Table 5 also describes to what extent particular business lines — brokerage, fiduciary, and insurance services — were offered online. Consistent with their practices in the physical world, larger banks are much more likely to offer brokerage services than smaller banks; the

online pattern is less clear for offerings of insurance and fiduciary services, although banks under $100 million in assets are least likely to offer any of these services.[16]

To gain a clearer picture of the typical range of Internet services available at banks in different size categories, we defined two alternative "menus" of Internet banking services. "BASIC" Internet banking is defined as the three core Internet banking services of balance inquiry, funds transfer, and bill payment. We define "PREMIUM" Internet banking as BASIC plus at least three other services. Figure 2 shows the proportion of banks by size category that offer only BASIC services to those that offer PREMIUM services. Small Internet banks are

Figure 2—Larger banks offer a greater range of Internet banking services



* BASIC service includes balance inquiry, funds transfer, and bill payment. PREMIUM service includes BASIC and at least three other online services.

Source: Office of the Comptroller of the Currency

more likely to offer only the BASIC services; only 14 percent of the smallest banks offer the PREMIUM range. But nearly 60 percent of the largest banks offer the PREMIUM range. More

[16] As Table 4 shows, 41.5 percent of the largest transactional banks offer fiduciary services online. That percent is lower than the percent of the largest banks offering six of the other 10 online services. This relatively low percentage appears to be consistent with more general findings about the somewhat lackluster competitive position of large banks in offering retirement services, both online and by traditional channels. See Robertson, Cambruzzi, Jacques, Nigro, Pate, Rich, and Steele (2000) for a detailed study of this issue.

generally, banks holding assets of more than $1 billion are at least two-and-a-half times more likely than banks holding assets of less than $1 billion to offer customers a PREMIUM package of services. The evidence indicates that, while small banks can establish an online presence, they are currently less likely to compete with large banks on the basis of the range of product offerings. To the extent that product variety attracts and maintains a strong customer base, small banks may be at a disadvantage to large banks.

Web site privacy statements

Both banks and their customers stand to benefit substantially using the Internet to collect information. Customers can benefit from allowing banks to collect and integrate large amounts of personal information that help banks to tailor a wide range of products to individual demands. However, these same information collection, analysis, and distribution activities raise questions related to personal privacy protection.[17] In response, many banks post an online statement of their policies about the collection and use of customer information. Our database includes information on how many transactional banks had such a statement on their Web site. Table 6 summarizes that information.[18]

More than four-fifths of transactional Internet banks had a privacy policy statement on their Web site in Q3 1999. That number has more than doubled since mid-1998.[19] Large banks were more likely to post an online privacy policy than small banks. Indeed, 100 percent of the

[17] See Office of the Comptroller of the Currency (1999a) for a discussion of privacy issues facing banks offering Internet banking.

[18] Note that our data is confined to whether or not transactional Internet banks posted online a privacy statement; it does not include an evaluation of the nature of banks' privacy statements. For an analysis of attributes of the online privacy statements of depository institutions, see the Interagency Web Site Privacy Report (1999).

[19] See Egland, Furst, Nolle, and Robertson (1998) for a further information on the 1998 figures.

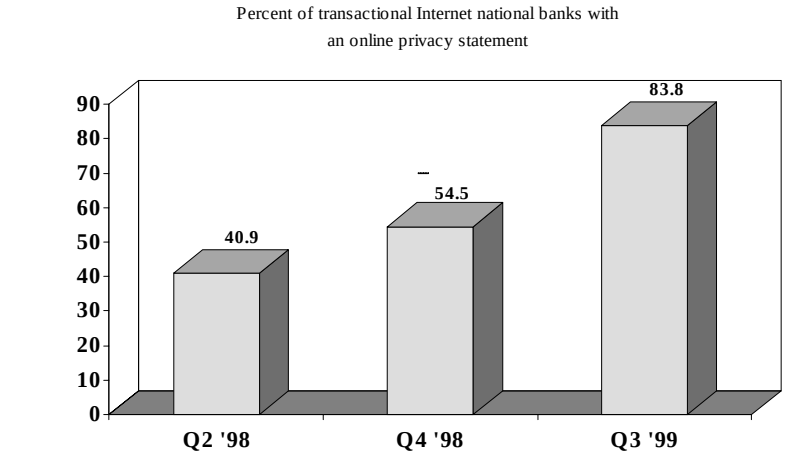
largest banks posted one, and nearly every bank holding assets of more than $1 billion posted one, as compared with 75 percent of the smallest banks. However, the discrepancy between large and small bank practices in this respect narrowed considerably during 1999. Figure 3 illustrates the fact that online privacy statements have become more common for transactional Internet banks over time.

Table 6. Substantial increases in number of Web site privacy policy statements.

	Percent of transactional Internet national banks with a privacy policy statement on the Web site		
Asset size category	**Q2 1998**	**Q4 1998**	**Q3 1999**
All	40.9	54.5	83.8
Less than $100 million	21.4	35.7	75.0
$100 million to less than $1 billion	32.6	41.3	79.5
$1 billion to less than $10 billion	37.5	62.5	97.7
$10 billion and over	75.0	95.0	100.0

Source: Office of the Comptroller of the Currency; Egland, Furst, Nolle, and Robertson (1998).

Figure 3—Most transactional Internet national banks have an online privacy statement



Source: Office of the Comptroller of the Currency

IV. Internet and non-Internet banks: performance comparisons

In comparing transactional Internet banks in mid-1998 to non-Internet banks, Egland, Furst, Nolle, and Robertson (1998) found little besides relative size to distinguish the two groups. As Tables 7, 8, and 9 illustrate, by Q3 1999 differences between Internet and non-Internet banks had begun to emerge in balance sheet composition and funding, in sources of income and expenditures, and in measures of performance.[20]

[20] We make extensive use of univariate comparisons between Internet and non-Internet bank characteristics. Because the importance of bank size has already been established, we "control" for differences in bank size, roughly speaking, by stratifying the data by asset size categories. This "first-step" approach is useful for an initial investigation to establish a foundation of stylized facts.

Portfolio composition, income, and expenses

Table 7 shows major lending and funding characteristics for Internet and non-Internet banks.[21] Overall, on the asset side, Internet banks have a relatively greater focus on business lending (C&I loans) and credit card lending. On the liability side, Internet banks generally rely less on deposits for funding and make greater use of purchased funds relative to deposits. For small banks, this result is consistent with recent business press reports that they are concerned about traditional sources of funding, and have begun to view the addition of Internet banking as a way to offer products that reduce their dependence on core deposits.[22]

Differences in business strategies between Internet and non-Internet banks are also evident in Table 7. The first column in Table 7 shows the ratio of noninterest income to net operating revenue. This ratio is a rough proxy for the amount of revenue being generated by "nontraditional" activities. Internet banks generated a substantially higher proportion of their income from nontraditional activities than did non-Internet banks. Roughly speaking, Internet banks received about 50 percent more of their revenue from noninterest income than do non-

[21] In the tables throughout the remainder of the paper comparing structure and performance characteristics of Internet to non-Internet banks, we calculated a difference of means test to ascertain the likelihood that Internet banks and non-Internet banks were different with respect to a given characteristic. For each pair of observations in a table, we provide a probability value (p-value) for the hypothesis that the means in the Internet and non-Internet samples are the same. A lower p-value indicates a greater likelihood that the two figures being compared represent real differences between categories of banks (i.e., Internet vs. non-Internet, etc.). A common practice in empirical economics is to consider p-values at or below 0.05 as indicating a statistically significant difference, while some studies (particularly ones with small samples) use a cut-off point of 0.10 for asserting statistical significance.

[22] See, e.g., Winig (2000), who reports that 85 percent of community bank CEOs who participated in a recent Grant Thornton survey agreed with the statement that "Funding with core deposits will be more difficult in three years," because consumers continue to look for higher yielding alternatives to bank accounts. Correspondingly, the same survey reveals a surge in community banker interest in offering Internet banking.

Table 7. Internet and non-Internet national banks: selected balance sheet ratios [a, b]
(Q3 1999)

	Loan composition (ratios in percent)		Funding (ratios in percent)	
Asset size category	**C&I loans/ loans**	**Credit card loans/ loans**	**Deposits/ assets**	**Fed funds purchased/ deposits**
Less than $100 million:				
Internet banks	20.4	0.5	82.1	2.1
Non-Internet banks	16.9 (0.001)***	0.4 (0.691)	85.1 (0.000)***	1.5 (0.276)
$100 million to $1 billion:				
Internet banks	17.9	1.7	78.9	7.4
Non-Internet banks	18.1 (0.209)	0.9 (0.000)***	82.3 (0.000)***	3.9 (0.000)***
$1 billion to $10 billion:				
Internet banks	24.5	4.2	68.6	20.4
Non-Internet banks	17.8 (0.003)***	0.9 (0.011)**	71.8 (0.299)	12.1 (0.023)**
$10 billion and over:				
Internet banks	34.1	2.8	66.1	11.7

Source: Office of the Comptroller of the Currency

[a] Numbers in parentheses are p-values for the difference of means test for Internet and non-Internet values in each cell. *** = significant at the 1% or better level; **=significant at the 5% level; *=significant at the 10% level.
[b] Non-Internet banks include banks with non-transactional Web sites.

Internet banks. That pattern is consistent with a business strategy of using the Internet to target businesses and more affluent consumers, in the belief that these customers will be interested not only in loans but in other services that yield fee income.[23]

In addition to revenue enhancement, Internet banking could enable banks to reduce costs of operation. In particular, greater reliance on Internet banking might allow banks to reduce expenditures on "brick and mortar." To the extent this is so, Internet banking would be considered a *causal* factor in generating lower expenses related to maintaining physical

[23] See Gold (2000) for example. *Bank Technology News* (1999d) sites a Forrester Research Inc. study showing that higher income individuals are more likely to be active Internet banking users.

branches. On the other hand, one might expect that banks maintaining expensive branch networks might have the greatest incentive to adopt Internet banking. From this perspective, the adoption of Internet banking would be the *effect* of existing characteristics of banks. The data in Table 8 show that, consistent with the first hypothesis, Internet banks over $100 million in assets had lower expenses on building and equipment relative to net operating revenue. However, among the smallest Internet banks — the majority of which adopted Internet banking after the second quarter of 1998 — building and equipment expenditures were higher than for non-Internet banks. This might indicate that smaller banks with high costs of maintaining a branch network are motivated to adopt Internet banking by the prospect of future cost savings. This result might also be due to small banks' high initial costs of equipment (the call report aggregates expenditures on buildings and equipment) when establishing an online presence. Further research is necessary to establish whether Internet banking will reduce costs associated with physical branch networks, and whether relatively high branch-related expenses is motivating banks to adopt Internet banking.

Table 8. Income and expenses: Internet and non-Internet national banks[a, b]
(Q3 1999)

Asset size category	"Non-traditional" income: Noninterest income/ net operating revenue[b] (percent)	Expenses: Premises & fixed assets/ net operating revenue[b] (percent)
Less than $100 million:		
Internet banks	22.0	11.7
Non-Internet banks	14.6 (0.000)***	9.3 (0.000)***
$100 million to $1 billion:		
Internet banks	23.1	8.2
Non-Internet banks	16.8 (0.000)***	9.1 (0.000)***
$1 billion to $10 billion:		
Internet banks	36.8	7.2
Non-Internet banks	23.0 (0.000)***	8.0 (0.111)
$10 billion and over:		
Internet banks	40.1	8.1

Source: Office of the Comptroller of the Currency

[a] Numbers in parentheses are p-values for the difference of means test for Internet and non-Internet values in each cell. *** = significant at the 1% or better level; **=significant at the 5% level; *=significant at the 10% level.
[b] Non-Internet banks include banks with non-transactional Web sites.
[c] Net operating revenue = net interest income plus noninterest income.

Performance measures

Even the banks most successful at offering Internet banking currently serve a relatively small share of their customer base with this delivery channel.[24] As a result, it has been difficult for banks and industry analysts to determine yet whether Internet banking has had a significant

[24] The penultimate section of this article discusses "demand" for Internet banking in more detail.

impact on bank performance.[25] For example, in their comparison of Internet and non-Internet banks in mid-1998, Egland, Furst, Nolle, and Robertson (1998) observed that they did not find significant differences in profitability, efficiency, or credit quality. But, as our new information shows, by Q3 1999, differences in performance between Internet and non-Internet banks had emerged.

Table 9 compares the profitability, efficiency, and credit quality of Internet banks with those of non-Internet banks, by asset size category, in Q3 1999. What stands out most distinctly in this table are the performance differences between the Internet banks and non-Internet banks in the smallest size category compared to larger banks. For example, while Internet banks holding assets of more than $100 million were more profitable than non-Internet banks, the smallest Internet banks were significantly less profitable than the smallest non-Internet banks.[26] The smallest banks were also less efficient than non-Internet banks, as measured by the ratio of noninterest expense to net operating revenue ("accounting efficiency"), a commonly used measure of cost efficiency.[27] There was no statistically significant difference between the accounting efficiency of large Internet banks and large non-Internet banks. The smallest Internet banks had better credit quality than the smallest non-Internet banks; for large banks the pattern is less distinct. As discussed below, the differences for small banks were likely due to the relative performance of *de novo* banks that offered Internet banking.

[25] See, for example, Azarchs (2000) and Jordan and Katz (1999). In a recent study, Moody's Investors Service (2000a) says that "Moody's does not foresee much impact from the Internet on large U.S. banks' core profitability or competitive position — at least in the intermediate term." Somewhat in contrast, Azarchs (2000) cites a Booz Allen & Hamilton Inc. study arguing that "a mature Internet bank could operate at a 15% - 20% expense-to-revenue ratio" compared with a ratio of about 60 percent for most banks. Hitt, Frei, and Harker (1999) found that banks' investment in Internet banking had not resulted in "new, profitable customers to the firm, as many banks had hoped. Rather, it seems to be to retain high-value customers" (p. 132), a result echoed in Hitt and Frei (1999).

[26] We also used return on assets as a measure of profitability and found very similar results.

[27] Following DeYoung (1999), we use the term "accounting efficiency" for this measure of cost efficiency.

Table 9. Internet banks and non-Internet national banks: performance comparisons[a, b]
(Q3 1999)

Asset size category	Profitability: Return on equity (percent)	Accounting efficiency: Noninterest expense to net operating revenue[c] (percent)	Credit Quality: Noncurrent loans to total loans[d] (percent)
Less than $100 million:			
Internet banks	6.34	77.90	0.52
Non-Internet banks	10.13 (0.000)***	65.52 (0.000)***	0.87 (0.002)***
$100 million to $1 billion:			
Internet banks	14.15	59.59	0.68
Non-Internet banks	13.03 (0.000)***	60.57 (0.282)	0.73 (0.249)
$1 billion to $10 billion:			
Internet banks	18.26	56.26	0.81
Non-Internet banks	15.68 (0.003)***	54.74 (0.256)	0.56 (0.003)***
$10 billion and over:			
Internet banks	15.35	57.84	0.82

Source: Office of the Comptroller of the Currency.

[a] Numbers in parentheses are p-values for the difference of means test for Internet and non-Internet values in each cell. *** = significant at the 1% or better level; **=significant at the 5% level; *=significant at the 10% level.
[b] Non-Internet banks include those with non-transactional Web sites.
[c] A higher ratio indicates lower efficiency.
[d] A higher ratio indicates lower credit quality.

Interestingly, nonperforming loans were significantly higher for Internet banks in the $1 billion to $10 billion assets size category. This is consistent with the results in Table 7 that showed these banks more heavily concentrated in credit card and business lending than similarly sized non-Internet bank. The smallest Internet banks had fewer nonperforming loans than their non-Internet peers. This suggests that these banks' poorer profitability and accounting efficiency ratios are not related to credit losses.

***De novo* banks**

To investigate further the performance differences of small banks, we focused on two different groups of Internet banks: *de novo* Internet banks (in operation a year or less as of Q3 1999) and "mature" Internet banks (have offered Internet banking at least since Q2 1998 according to Egland, Furst, Nolle, and Robertson (1998)). Segmenting our data this way allowed us to investigate two possible reasons small Internet banks performed more poorly than small non-Internet banks: "newness" of banks and "newness" of Internet banking.

De novo banks as a rule perform more poorly than established banks, a pattern that generally holds for at least their first three years.[28] Because most *de novos* are small (i.e., have less than $100 million in assets), we reasoned that their performance could have affected the measures of performance for the entire group of small banks.[29] That suspicion was heightened by our discovery that, among small banks, *de novo* banks as a group were three times more likely to offer Internet banking than mature small banks[30] In addition, it is reasonable to conjecture that the performance of a *de novo* bank might be significantly affected by its choice to offer Internet banking. On the cost side, there will be start-up expenses as well as advertising and operating expenses.[31] On the revenue side, *de novo* banks offering Internet banking may have a strategy that relies heavily on their ability to attract customers using the Internet, and such a strategy may not produce strong revenues given the relatively slow pace of customer adoption of

[28] See DeYoung (1999) for a recent analysis of the performance of *de novo* banks.

[29] Fifty-six of the 59 (one year or younger) *de novo* national banks in Q3 1999 were in the under $100 million asset size category.

[30] As the memorandum item in Table 10 shows, 19.2 percent of small de novo banks offered Internet banking, while only 6.1 percent of "mature" small banks offered Internet banking.

[31] This may be true even if much of the set-up and operation of the bank's Internet banking is outsourced to third party vendors.

Internet banking. In light of this, we separated *de novo* national banks from the rest of the small national banks.

Table 10 compares the nine *de novo* Internet national banks and forty-seven *de novo* non-Internet national banks in Q3 1999 across key performance characteristics. The *de novo* Internet banks were much less profitable and less efficient than *de novo* non-Internet banks. In a

Table 10. *De novo* national banks:
Internet banks and performed worse than non-Internet banks[a, b]
(Q3 1999)

	Internet banks	**Non-Internet banks[c]**
Number of banks	9	47
Profitability[d]	-14.70	-8.64 (0.082)*
Accounting efficiency[e]	238.09	133.14 (0.024)**
Premises & fixed assets-to-net operating revenue (percent)	33.36	19.60 (0.002)***
"Traditional" income[f]	87.86	75.99 (0.253)

Memorandum: Among small banks, *de novo* banks are more than 3 times as likely to offer Internet banking as banks in existence 3 years or more:

Percent of *de novo* banks that offered Internet banking: 19.2
Percent of mature small banks that offered Internet banking: 6.1

Source: Office of the Comptroller of the Currency.

[a] *De novo* banks are those in the $100 million or less asset size category operating for one year or less as of Q3 1999.
[b] Numbers in parentheses are p-values for the difference of means test for Internet and non-Internet values in each cell. *** = significant at the 1% or better level; **=significant at the 5% level; *=significant at the 10% level.
[c] Non-Internet banks include those with Web sites that are not transactional.
[d] Return on equity, in percent.
[e] Noninterest expense to net operating revenue, in percent. A higher ratio indicates lower efficiency.
[f] Net interest income to net operating revenue, in percent.

proximate sense, contributing considerably to these results was that *de novo* Internet banks exhibited a much higher expense ratio than did non-Internet *de novo* banks. As discussed previously, the data do not allow us to ascertain the composition of the expenditures for premises and fixed assets. Nevertheless, it is possible that expense ratios were higher for *de novo* Internet banks in part because of costs incurred to set up Internet banking.[32]

Internet experience and bank performance

Clearly, the combination of being a new bank and of offering Internet banking results in relatively poor performance. But it is also possible that the poor performance of small Internet banks versus non-Internet banks is the result of short run costs of making an investment in Internet banking, one that could be expected to yield substantial gains in the longer run. Few banks have had Internet banking for more than several years, so it is difficult to ascertain what the "long run" is with respect to Internet banking. Nevertheless, our data allow us to explore whether, among *mature* small banks offering Internet banking, those that have offered it for a relatively long time outperformed those that only recently began to offer it.[33] Making such a comparison separates "newness of bank" from "newness of Internet banking."

The results of subtracting *de novos* and then segmenting mature small Internet banks by "Internet experience" are presented in Tables 11 and 12. Table 11 shows that the less profitable non-Internet banks in Table 9 are just as profitable as Internet banks when *de novo* banks are

[32] Table 10 also shows that *de novo* Internet banks received a higher proportion of their revenue from traditional interest income than did non-Internet *de novos*. While the statistical significance of this result is weak, it stands in marked contrast to the significantly lower reliance on traditional income by Internet banks in other size categories. That outcome could reflect difficulties for *de novo* Internet banks in successfully developing customer and business relationships via the Internet.

[33] We define "mature" banks as those in operation for more than three years as of Q3 1999. We compared the performance of "Internet-experienced" banks (i.e., those offering Internet banking since at least Q2 1998) to that of banks that began offering Internet banking after Q2 1998, for all size categories. We found no statistically

excluded. However, small Internet banks are still less efficient than small non-Internet banks, despite the exclusion of *de novo* banks. Hence, it is not the newness of the bank that explains this aspect of worse performance for small Internet banks.

Table 11—Mature small national banks: Internet banks are less efficient, but not less profitable[a,b]
(Q3 1999)

	Non-Internet banks	Internet banks
Number of banks	1,009	61
Profitability[c]	11.13	10.36
p-value	(0.232)	
Accounting efficiency[d]	64.50	70.50
p-value	(0.000)***	
Premises and fixed assets-to-net operating revenue	9.02	10.41
p-value	(0.000)***	
"Traditional" income[e]	85.51	78.24
p-value	(0.000)***	

Source: Office of the Comptroller of the Currency.

[a] "Mature" small banks are those in the $100 million or less asset size category in operation for more than three years as of the third quarter of 1999. Non-Internet banks include those with Web sites that are not transactional.
[b] Numbers in parentheses are probability values (p-values) for a statistical test of the hypothesis that the mean values in each cell are equal. Thus, a smaller p-value indicates a greater likelihood that the true mean value of the Internet sample differs from the non-Internet sample. Asterisks indicate the statistical significance of the difference of means test with:
*** = significant at the 1% level
** = significant at the 5% level
* = significant at the 10% level
[c] Return on equity, in percent.
[d] Noninterest expense to net operating revenue, in percent. A higher ratio indicates lower efficiency.
[e] Net interest income to net operating revenue, in percent.

significant difference in performance between those two "vintages" of Internet banks in the banks over $100 million in assets. Hence, our discussion in the text is confined to the smallest banks.

To investigate whether "newness of offering Internet banking" might explain the poorer efficiency results for small Internet banks, we divided the 61 small Internet banks into two groups. "Internet-experienced" banks are those that offered Internet banking no later than the second quarter of 1998, and "Internet-inexperienced" banks are those that began to offer Internet banking sometime between the beginning of the third quarter of 1998 and the end of the third quarter of 1999.[34] We then compared both the small Internet-experienced and the Internet-inexperienced banks to small non-Internet banks.

The results, summarized in Table 12, show that there is no statistical difference between the accounting efficiency of Internet-experienced banks and that of non-Internet banks. However, the accounting efficiency of small banks only recently offering Internet banking was poorer by a statistically significant margin than that of non-Internet banks. Hence, the lower efficiency of small Internet banks as a group is attributable to those small Internet banks just recently beginning to offer Internet banking; i.e., it appears that Internet experience does matter for small banks.

Table 12 also shows that, for a key measure of "input" costs—the ratio of premises and fixed assets to net operating revenue—Internet-inexperienced banks were significantly worse than non-Internet banks. This fact helps explain the greater inefficiency of small banks for which Internet is relatively new. Their expense and efficiency disadvantages may be a temporary consequence of investing in Internet banking.[35] It is interesting to note that, although

[34] As indicated previously, we have no record of the exact date banks began offering Internet banking to their customers.

[35] The statistical results do not allow us to say for certain that "newness of Internet" for small banks *causes* poorer efficiency. It is possible that another set of factors explains both why some small banks chose not to be in the vanguard of banks offering Internet banking, and why they had poorer accounting efficiency ratios than did the 11 Internet-experienced banks that were among the "early adopters" of Internet banking.

Table 12—Mature small national banks: Does Internet experience matter?[a, b]
(Q3 1999)

	Non-Internet banks	Internet-experienced banks	Internet-inexperienced banks
Number of banks	1,009	11	50
Profitability[c]	11.13	9.95	10.58
p-values		(0.400)	(0.434)
Accounting efficiency[d]	64.50	63.10	71.61
p-values		(0.641)	(0.000)***
Premises and fixed assets-to-net operating revenue	9.02	7.99	10.85
p-values		(0.233)	(0.000)***
"Traditional" income[e]	85.51	75.94	75.25
p-values		(0.000)***	(0.000)***

Source: Office of the Comptroller of the Currency.

[a] "Mature" small banks are those in the $100 million or less asset size category in operation for more than three years as of the third quarter of 1999. Non-Internet banks include those with Web sites that are not transactional. "Internet-experienced" banks are those that have offered Internet banking since at least the second quarter of 1998. "Internet-inexperienced" banks are those that began to offer Internet banking after the second quarter of 1998.

[b] Numbers in parentheses are p-values for the difference of means tests for Internet-experienced banks compared to non-Internet banks, and for Internet-inexperienced banks compared to non-Internet banks, respectively. The p-values are probability values for a statistical test of the hypothesis that the mean values in each cell are equal. Thus, a smaller p-value indicates a greater likelihood that the true mean value of the Internet sample differs from the non-Internet sample. Asterisks indicate the statistical significance of the difference of means test with:

*** = significant at the 1% level
** = significant at the 5% level
* = significant at the 10% level

[c] Return on equity, in percent.

[d] Noninterest expense to net operating revenue, in percent. A higher ratio indicates lower efficiency.

[e] Net interest income to net operating revenue, in percent.

neither the Internet-experienced nor the Internet-inexperienced banks exhibited statistically different profitability than non-Internet banks, both groups of Internet banks relied less on traditional interest-yielding activities than non-Internet banks. These results suggest that while

small banks that have only recently begun to offer Internet banking have relatively high expenses, growth in revenues are sufficient to maintain overall profitability.

Safety, soundness, and information technology

When federal bank regulators regularly examine for safety and soundness, they issue CAMELS ratings to each bank. CAMELS range from "1" (best rating) to "5" (worst rating). Separate examinations evaluate banks' risk management of the information technology (IT), using the Uniform Rating System for Information Technology (URSIT). Like CAMELS ratings, IT exam scores range from 1 to 5.[36]

Table 13 compares the composite and management components of the CAMELS and IT ratings for Internet and non-Internet banks by size. (See Table 13 at the end of the document.) Because relatively few banks offered Internet banking, one might expect the "early adopters" to be more forward-looking and astute with respect to technology than non-Internet banks, and that this astuteness would be reflected in examiner ratings. The figures displayed in Table 13 provide weak support for this conjecture, inasmuch as Internet banks generally had better IT and CAMELS ratings than non-Internet banks, although the p-values generally are above 10 percent.[37] There is one exception to the general rule that Internet banks receive better supervisory

[36] CAMELS ratings cover six aspects of bank safety and soundness: capital adequacy (C), asset quality (A), management (M), earnings (E), liquidity (L), and sensitivity to market risk (S). See the Federal Register: January 20, 1999 (volume 64, number 12, pp. 3109-3116) for a detailed description of the URSIT, which is "an internal supervisory examination rating system used by federal and state regulators to assess uniformly financial institution and service provider risks introduced by information technology and for identifying those institutions and service providers requiring special supervisory attention." Note, therefore, that URSIT exams are given to service providers over which regulators have supervisory authority, as well as to banks.

[37] The relative weakness of these results might be due to the overall strength of national banks during this period, and the resultant relatively strong supervisory ratings. See Office of the Comptroller of the Currency (1999b) for an analysis of national banking industry performance during the third quarter of 1999. There is evidence showing that banks that effectively manage IT realize greater stock prices. See *Bank Technology News* (1999a), which cites a Barents study comparing stock prices of "well-run IT banks" with the banking industry average, 1992-1998. See also O'Sullivan (1998), who summarizes research suggesting that IT spending on technology staff boosts profitability.

ratings: Internet banks in the $1 billion to $10 billion size category on average received worse IT ratings, though these same banks on average received better CAMELS ratings.

V. The determinants of Internet banking

Drawing on the preceding analysis, this section estimates a multivariate logistic model to determine the factors explaining which banks are most likely to choose to offer Internet banking. Moving to a multivariate framework allows us to see whether the univariate relationships described above continue to hold after controlling for relevant factors. In addition to estimating the factors determining adoption, we also estimate a model to determine why some banks offer a wide range of Internet banking services.

Explaining the decision to offer Internet banking: A multivariate analysis

To test for the factors explaining which banks choose to offer Internet banking, we limit our sample to national banks that did not offer transactional Internet banking at the end of Q2 1998. By limiting our sample in this way, we can ensure that the independent variables used in the regressions measure bank characteristics *prior to* the adoption of Internet banking. We then estimate a logistic regression with the dependent variable INTNEW which takes on a value of one if a bank adopted Internet banking by the end of Q3 1999 and zero otherwise. The explanatory variables in the model are characteristics of the bank as of Q2 1998, before any of the banks in our sample adopted Internet banking. Since a bank in our sample had to be in existence as of Q2 1998, *de novo* banks that are less than five quarters old as of Q3 1999 are excluded from our sample.

Explanatory variables include the following:

- ASSETS is the size of a bank, measured by assets in Q2 1998. Our previous analysis leads us to expect that, controlling for other factors, the larger the bank the more likely it will be to choose to offer Internet banking; i.e., we expect the coefficient on this variable to be positive.

- YOUNG takes on a value of one if the bank is less than three years old as of Q3 1999. Since we are using Q2 1998 data as our regressors, banks that are a year or less old as of Q3 1999 are not in our sample. This variable controls for "newness" of a bank. We expect this coefficient to be positive as it is likely that some new banks were formed based on a belief that new technology created new business opportunities.

- BHC takes on a value of one if a bank is a member of a bank holding company, zero otherwise. Our expectation is that, other things equal, a bank that is a member of a bank holding company is more likely to offer Internet banking, because a bank holding company can use a single Web site to provide Internet banking access to customers of multiple banks in the holding company.

- URBAN takes on a value of one if a bank is located in an urban area, and zero if it is not.[38] The univariate analysis indicated that banks in urban areas are more likely to offer Internet banking to their customers than banks in nonurban areas (see Table 2, above). Our conjecture is that banks in more densely populated areas are likely responding to greater customer demand for Internet banking and to more intense competitive pressures from rival banks in the same market. Hence, we expect a positive coefficient for this variable.

- DEPOSITS is the ratio of deposits to assets on a bank's balance sheet in Q2 1998. Banks that are less reliant on traditional sources of funding may tend to pursue a more aggressive overall business strategy, including the adoption of Internet banking. Our sign expectation for this variable is negative.

- EXPENSES is the ratio of expenses for premises and fixed assets to net operating revenue in Q2 1998. The direction of this effect is ambiguous. On the one hand, banks with relatively high expenses on premises and fixed assets may view adoption of Internet banking as a way to reduce expenditures devoted to maintaining a branch network.[39] On the other hand, some analysts have argued that banks without a large branch network will seize on offering Internet banking as an inexpensive means to expand their customer base.

- NIINCOME is the ratio of noninterest income to net operating revenue in Q2 1998. One measure of the "aggressiveness" of a bank's business strategy is how much of its income comes from fees. We hypothesize that banks with a greater reliance on nontraditional revenue are more likely to view Internet banking as a way to market fee-generating services,

[38] As noted in Table 2, an urban area is defined as a Standard Metropolitan Statistical Area.

[39] But note that because we are not able to decompose such expenditures into those associated solely with physical offices, one has to use caution in interpreting this variable.

and are more likely to be institutions that adopt innovative services as part of an overall aggressive business strategy.

- ROE is return on equity in Q2 1998. We include this measure of bank profitability in our empirical model to test whether it has an independent effect on the decision to offer Internet banking.[40] The direction of the effect of ROE is ambiguous. It is possible that more profitable banks could choose to incur the costs of offering Internet banking both because they are financially more able to do so, and because they believe doing so will help them maintain their competitive position. However, less profitable banks might be more willing to invest in Internet banking to improve their performance.

- INEFFICIENCY is the ratio of noninterest expense to net operating revenue (i.e., our "accounting efficiency" measure) in Q2 1998. The higher the value of this variable, the more inefficient is the bank. Our sign expectation for this variable, like ROE, is ambiguous. The estimated coefficient for the variable could be positive if inefficient banks viewed Internet banking as a means to become more efficient. Alternatively, the coefficient could be negative if relatively efficient banks are more innovative and better able to incorporate new technology and new services.

- CAMELS is the composite safety and soundness rating given by examiners to a bank as of Q2 1998. A higher CAMELS number indicates a poorer exam rating. We include it in the model to test whether there is an independent influence for the overall safety and soundness character of a bank on its decision to offer Internet banking. The sign for this variable is ambiguous.

To summarize, our model is:

$$\begin{array}{c} \overset{(+)}{} \quad \overset{(+)}{} \quad \overset{(+)}{} \quad \overset{(+)}{} \quad \overset{(-)}{} \quad \overset{(?)}{} \\ \text{INTNEW} = f\,(\text{ASSETS, YOUNG, BHC, URBAN, DEPOSITS, EXPENSES,} \\ \overset{(+)}{} \quad \overset{(?)}{} \quad \overset{(?)}{} \quad \overset{(?)}{} \\ \text{NIINCOME, ROE, INEFFICIENCY, CAMELS)} \end{array}$$

where the sign in parentheses above the variable name indicates the expected sign of the regression coefficient (and a "?" indicates that we have no *a priori* sign expectation for the variable).

[40] We speculated in the previous section that profitability is positively *correlated* with Internet banking. In the recent past, banks giving greater emphasis to fee-generating activities have tended to be more profitable than other banks; we reasoned above that such banks are also more likely than other banks to choose to offer Internet banking. In our multivariate model we wish to test whether, taking account of how much a bank relies on noninterest income, differences in profitability partly explain why banks offer Internet banking.

The results of the logit estimation of our model, both for national banks regardless of size, and for national banks under $100 million in assets ("small" banks), are displayed in Table 14. Looking first at the "all national banks" results, all the coefficients have the expected sign, and all but one of the variables (DEPOSITS) are statistically significant at the 10 percent level or greater. As hypothesized, *ceteris paribus*, the larger a bank, the more likely it is to offer Internet banking; a bank that is a member of a bank holding company is more likely than an independent bank to offer Internet banking; and banks located in urban areas are more likely to offer Internet banking. In addition, the coefficient on YOUNG is significantly positive, indicating that newer banks are more likely to offer Internet banking.

NIINCOME has a positive coefficient, indicating that banks emphasizing nontraditional activities are more likely to offer Internet banking. The coefficient on DEPOSITS is negative, as expected, but not significant. The positive coefficient on EXPENSES is consistent with the hypothesis that banks with relatively high fixed expenses may see Internet banking as a way to reduce expenses on premises and fixed assets.

Coefficients on the various performance variables all seem to indicate that better performing banks are more likely to adopt Internet banking. Thus, the signs on ROE are positive and the coefficients on accounting INEFFICIENCY and CAMELS are negative. These results are generally consistent with the view that, on average, early adopters of Internet banking are relatively profitable and relatively safe institutions.

Overall, the results of the logit estimation are similar for small banks as for the all-bank sample, indicating that many of the same factors explain the decision to offer Internet banking for both small and large banks. Among the differences in the small banks' results (see the right-hand column of Table 14) is that the deposits-to-assets variable (DEPOSITS) is statistically

Table 14. Which bank characteristics explain the decision to offer Internet banking?

[Dependent variable: INTNEW = 1 if the bank adopted Internet banking between Q3 1998 and Q3 1999][a]

Variable	All national banks	Small national banks[b]
	Estimate	Estimate
Constant	-2.7940***	-3.5852***
(p-value)	(0.000)	(0.000)
ASSETS	8.3300 E-7***	0.0016 E-2***
(p-value)	(0.000)	(0.009)
YOUNG	0.7051**	1.2828***
(p-value)	(0.047)	(0.007)
BHC	0.6506***	0.3641
(p-value)	(0.002)	(0.290)
URBAN	0.7363***	0.7901***
(p-value)	(0.000)	(0.009)
DEPOSITS	-0.7041	-2.5317***
(p-value)	(0.294)	(0.010)
EXPENSES	7.5198***	5.7962*
(p-value)	(0.000)	(0.091)
NIINCOME	2.6809***	3.4385**
(p-value)	(0.000)	(0.016)
ROE	2.3636***	2.8679**
(p-value)	(0.009)	(0.044)
INEFFICIENCY	-0.9682*	0.0865
(p-value)	(0.092)	(0.937)
CAMELS	-0.2692**	-0.1518
(p-value)	(0.026)	(0.527)
No. of observations	2089	1169

Source: Office of the Comptroller of the Currency

*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

[a] Banks offering Internet banking prior to Q3 1998 were excluded.
[b] Small banks are those with less than $100 million in assets.

significant, indicating that small banks emphasizing traditional funding are less likely to offer Internet banking. We hypothesized above that a bank that is a member of a bank holding company is more likely to offer Internet banking, because a bank holding company can use a single Web site to provide Internet banking access to customers of multiple banks in the holding company. Somewhat surprisingly, affiliation with a multibank holding company is not significant in the small bank sample. While the relationship between ROE and adoption of

Internet banking is significantly positive in the small bank sample, the coefficients on INEFFICIENCY and CAMELS variables are not statistically significant. This might indicate that the relationship between performance and Internet adoption is somewhat weaker at smaller institutions.

Explaining the decision to offer Internet banking by "first movers"

Because a minority of banks offered Internet banking as of Q3 1999, those that did could be thought of as being in the vanguard. However, to avoid problems of simultaneity, we excluded from our estimation procedure banks offering transactional Internet banking prior to Q3 1998. It is possible that, despite the passage of only a few years since the beginning of the Internet banking "era," the characteristics of the "earliest" of the early adopters of Internet banking differ from more recent early adopters. To investigate this possibility, we estimate our adoption model for banks that adopted Internet banking by Q2 1998 - "first movers".

Our new dependent variable for the logit model is INTOLD, which takes on a value of 1 if the bank offered transactional Internet banking as of Q2 1998. Our lagged regressors are identical to the previous model except that the lagged financial variables are as of Q1 1997.[41] The estimation results for our "first mover" model are summarized in Table 15.

[41] We chose Q1 1997 to be consistent with the five quarter lag for the INTNEW model. Unlike the INTNEW model, we cannot know whether the regressors in the INTOLD model are measured prior to a bank's adoption of Internet banking. However, based on information from the FDIC, we estimate that fewer than 2 percent of national banks offered Internet banking at the beginning of 1998, so we know that most national banks offering Internet banking by Q2 1998 adopted it after Q1 1997. Note also that most industry observers date the transactional Internet banking "era" as beginning in 1996 (see Egland, Furst, Nolle, and Robertson (1998)).

Table 15. Bank characteristics explaining the decision to offer Internet banking: "first movers"

[Dependent variable: INTOLD = 1 if the bank was an Internet banking "first mover," i.e., if it adopted Internet banking before Q3 1998]

Variable	All national banks
	Estimate
Constant (p-value)	-2.4616** (0.026)
ASSETS (p-value)	8.102 E-8*** (0.000)
YOUNG (p-value)	1.6031** (0.047)
BHC (p-value)	1.1615*** (0.001)
URBAN (p-value)	0.8186*** (0.000)
DEPOSITS (p-value)	-1.8007* (0.101)
EXPENSES (p-value)	-1.6204 (0.493)
NIINCOME (p-value)	4.2731*** (0.000)
ROE (p-value)	-2.7173*** (0.001)
INEFFICIENCY (p-value)	-0.0818 (0.881)
CAMELS (p-value)	-0.3723** (0.026)
No. of observations	2346

Source: Office of the Comptroller of the Currency

*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

Across most of the explanatory variables in Table 15, the results for the first movers are very similar to those for the INTNEW results previously discussed (compare this column to the "All national banks" column in Table 14).[42] However, there is one substantial difference: for the

[42] Minor differences between the INTOLD results in Table 15 and the INTNEW results in Table 14 are that DEPOSITS (i.e., the deposits-to-assets ratio) is marginally significant in the INTOLD results but was not

first movers, ROE is significantly negative, whereas in the INTNEW results, ROE was significantly positive. As we discussed above, the expected sign on ROE is in general ambiguous. While more profitable banks generally will have greater resources to invest in innovative technologies, less profitable institutions might have been more willing to try to improve performance by "taking the plunge" into Internet banking at a time when many regarded it as still being at an unproven stage. Subsequently, as e-commerce grew into a significant economic factor and banks began to view offering Internet banking as a competitive business necessity, more profitable banks with innovative managers began adopting Internet banking.[43]

Factors explaining which banks offer a wide range of Internet banking services

Our next step was to investigate factors explaining which banks offering transactional Internet banking would choose to offer a broad range of Internet banking services. To do this, we included in our regression sample all national banks offering transactional Internet banking as of Q3 1999. Hence, we added back into the sample the "first movers" (banks offering Internet banking as of Q2 1998) and dropped banks that had not adopted Internet banking. The dependent variable in our regression analysis is PREMIUM, which takes on a value of one if an Internet bank offered balance inquiry, funds transfer, electronic bill payment (i.e., the three parts of the "BASIC" Internet banking package) plus at least three other Internet banking services. Our approach was to ascertain if the variables explaining which banks offer Internet banking also distinguish the more Internet-intensive banks from other transactional Internet banks. In

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statistically significant in the INTNEW results; and, unlike for the INTNEW results, the EXPENSES variable is not statistically significant in the INTOLD results.

[43] We chose not to report separate results for small bank first movers because only 29 small national banks offered Internet banking as of Q2 1998. The estimation results using only the small bank sample are highly sensitive to the inclusion or exclusion of a handful of influential observations.

addition, since it is plausible that banks will expand their services as they gain greater experience with Internet banking, we include a dummy variable, INTOLD, which takes on a value of 1 if the institution offered Internet banking as of Q2 1998.

The results of our logit estimation are displayed in Table 16:

Table 16. What explains the decision to offer a wide range of Internet banking services?

[Dependent variable: PREMIUM = 1 if a transactional Internet bank offered balance inquiry, funds transfer, electronic bill payment and at least 3 other online services]

Variable	All Internet national banks	Small Internet national banks[a]
	Estimate	Estimate
Constant	-1.0880	1.9895
(p-value)	(0.527)	(0.483)
ASSETS	3.6250 E-8***	0.0002 E-1
(p-value)	(0.003)	(0.329)
YOUNG	-0.9199	1.4535
(p-value)	(0.459)	(0.467)
BHC	2.5340**	-0.2816
(p-value)	(0.019)	(0.849)
URBAN	0.2480	0.0636
(p-value)	(0.462)	(0.951)
DEPOSITS	-4.2718***	-5.3779*
(p-value)	(0.001)	(0.079)
EXPENSES	6.6602**	-4.0052
(p-value)	(0.046)	(0.745)
NIINCOME	1.0916	2.8678
(p-value)	(0.392)	(0.563)
ROE	-2.2965	-2.0170
(p-value)	(0.184)	(0.746)
INEFFICIENCY	-2.5747***	-0.7805
(p-value)	(0.010)	(0.835)
CAMELS	0.7081***	-0.6685
(p-value)	(0.006)	(0.496)
INTOLD	1.4779***	1.6485*
(p-value)	(0.000)	(0.089)
No. of observations	431	79

Source: Office of the Comptroller of the Currency.

*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

[a] Small banks are those with less than $100 million in assets.

We report results for the entire sample and for the sample of Internet banks with assets less than $100 million. The all-banks results show that, consistent with our univariate analysis, larger banks are more likely to offer a wider range of Internet banking services. However, size is not a factor when we consider only banks with assets less than $100 million. In addition, the coefficient on BHC indicates that bank holding company members are more likely to offer a wider range of Internet banking services than independent banks. Perhaps surprisingly, this relationship cannot be found in our small bank sample. As would be expected, the coefficient on INTOLD is positive in both regressions, indicating that banks with greater Internet banking experience are more likely to offer an expansive range of services.

The statistically significant negative coefficient on DEPOSITS in both regressions indicates that, among Internet banks, those relying less on traditional funding tend to offer a wider range of Internet banking services, consistent with an overall more innovative business approach. While the coefficients on NIINCOME are in the expected direction, they are not statistically significant.

Large Internet banks with a higher ratio of premises and fixed assets to net operating revenue (EXPENSES) offer a wide range of Internet banking services. Such banks may encourage customers to use the Internet in order to be able to reduce fixed expenses. Small banks with high fixed expenses do not offer a wide range of Internet services.

There is no clear relationship between "better performance" and offering expanded Internet services. In the all-bank sample, the coefficient on ROE is insignificant. The coefficients on INEFFICIENCY and CAMELS are significant, but point in opposite directions. That is, the negative coefficient on INEFFICIENCY would indicate that inefficient banks are less likely to offer expanded services, while the positive coefficient on CAMELS would indicate

that banks with poorer exam ratings are more likely to offer PREMIUM Internet banking services. None of the performance ratios is significant in the small bank sample. Thus, while our results clearly indicate that banks with better performance ratios and exam ratings are more likely to offer Internet banking, we find no clear relationship between performance characteristics and breadth of services among those banks that have adopted Internet banking.

VI. Internet banking: plans and prospects

The allure of Internet banking is a strong one, to which many banks are responding.[44] In this section we present information on banks' plans for offering Internet banking. Our data set includes OCC examiners' responses to questions about the Internet banking plans of national banks through the end of 2000. Combining information about banks' future plans with the information on Q3 1999 Internet banking activities allows us to project what the "supply" of Internet banking in the United States will be when 2001 begins.[45] We then contrast this projected "supply" of Internet banking with information about possible future use of, or "demand" for, Internet banking.

Internet banking plans of national banks

Table 17 and Figure 4 summarize the projections. According to responses to the examiner questionnaire, the number of national banks offering Internet banking would more than double from Q3 1999 levels, so that by the beginning of 2001, 45 percent of national banks will be offering Internet banking. Banks offering transactional Internet banking would account for

[44] See, for example, *Retail Delivery News* (2000). A recent Ernst & Young study estimated that for the first time, bankers rated investment in Internet technology as their top technology-related spending priority. For a summary of the results of that study see *Bank Technology News* (1999e). In addition, Rhoads and Portanger (2000) report that pursuing an Internet-based strategy was a principal motivation behind the recent announcement of the merger of Deutsche Bank and Dresdner Bank, a combination that could create the largest bank in the world.

[45] Of course, our projections are accurate only to the extent that banks carry through with their plans.

more than 95 percent of national banking system assets. Because the largest banks already have Internet banking in Q3 1999, most of the growth in the number of banks offering Internet banking will come from the smallest banks. Although only 7 percent of small banks (i.e., those with less than $100 million in assets) offered Internet banking in Q3 1999, more than one-quarter of small banks will offer Internet banking by year-end 2000, according to our projections. In addition, by the beginning of 2001, almost all national banks holding assets of more than $1 billion will offer Internet banking. Together, national banks offering Internet banking could account for almost 93 percent of consumer-type deposits in national banks. To the extent the national banking industry is representative of the entire banking industry, that suggests that more than 9 out of 10 banking industry customers will have access to Internet banking by the beginning of 2001.

Table 17—Internet banking in 2001?

	Third quarter 1999	Fourth quarter 2000[a]
Number of national banks offering Internet banking[b]	464	1046
Percent of national banking system assets	89.2	95.2
Percent of small deposit accounts in the national banking system[c]	84.1	92.8
Percent of national banks in asset size category:		
All	19.9	44.9
Less than $100 million	7.1	25.3
$100 million to less than $1 billion	27.1	61.1
$1 billion to less than $10 billion	61.9	89.9
$10 billion and over	100.0	100.0

Memorandum:
46.2 percent of national banks had no plans as of the third quarter of 1999 to offer Internet banking in 2001 or beyond.

Source: Office of the Comptroller of the Currency

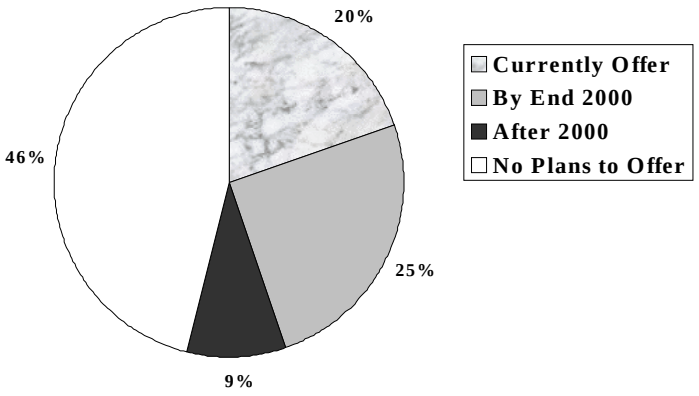
[a] Based on OCC examiners' knowledge of the Internet banking plans of national banks, as of the third quarter 1999. Percentage figures for assets, small deposit accounts, and banks per size category for fourth quarter 2000 were calculated by taking banks offering Internet banking as of the third quarter 1999, plus banks with plans to offer Internet banking by the end of 2000, relative to third quarter 1999 assets, small deposits, and numbers of national banks, respectively.

[b] FDIC-insured commercial banks excluding credit card banks.

[c] Percent of number of deposit accounts under $100,000.

Figure 4—Internet banking and national banks: potential growth

Percent of FDIC-insured national banks with transactional Internet banking



Source: Office of the Comptroller of the Currency

In addition to an increase in the number of banks offering Internet banking, many banks plan to increase their range of online services. Table 18, which provides detailed information about planned changes in product offerings, shows that, while banks' plans indicate a 125 percent increase in the number of banks offering Internet banking by year-end 2000, these plans project a 150 percent increase in the number of transactional Internet banks offering a PREMIUM set of online services.

Three planned product increases in particular stand out. As illustrated in Figure 5, the number of banks offering cash management services could increase by more than 500 percent, online insurance offerings by banks may increase 280 percent, and there may be more than a 200 percent increase in the number of banks offering electronic bill presentment. Significantly, large banks' plans to offer online business services (cash management) are more aggressive than those

of smallest banks (see Figure 6).[46] Such developments might represent increased large bank competition for community banks' business customers, who some analysts believe are enthusiastic about using Internet-based banking services.[47]

Table 18. Planned increases in key services to be offered by transactional Internet national banks by year-end 2000[a]

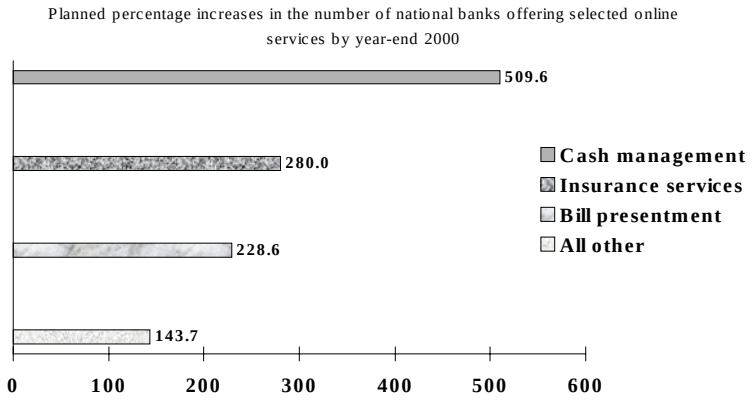
Type of service	Internet banks offering selected services: actual and planned		
	Actual Q3 1999	**Planned Q4 2000**	**Percent increase**
Number of transactional banks	464	1047	125.6
Balance inquiry and funds transfer	412	969	135.2
Bill payment	363	853	135.0
Credit applications	269	646	140.1
New account set-up	170	487	186.5
Brokerage	100	230	130.0
Cash management	73	445	509.6
Fiduciary	55	150	172.7
Bill presentment	49	258	426.5
Insurance	25	95	280.0
Basic[b]	360	836	132.2
Premium[c]	111	471	324.3

Source: Office of the Comptroller of the Currency.
[a] Based on OCC examiners' knowledge of the Internet banking plans of national banks, as of Q3 1999.
[b] "Basic" includes balance inquiry, funds transfer, and bill payment.
[c] "Premium" includes "Basic" and at least three other services.

[46] Indeed, several large banks have recently launched Web-based services targeting small businesses. See, for example, Hallerman (1999b), Marlin (1999), O'Brien (2000), Ptacek (2000 a and c), and Marjanovic (2000). O'Connell (2000) reports on a Meridien study which estimates costs for banks to install Internet-based cash management channels. Some industry observers have begun to speculate that servicing the needs of business customers, rather than consumer customers, is likely to be a relatively more profitable Internet strategy for banks. See, e.g., Ptacek (2000b), O'Brien (2000), and Toonkel (2000a). For an analysis of possible roles banks could play in business-to-business ("B2B") commerce, see Wenninger (2000).

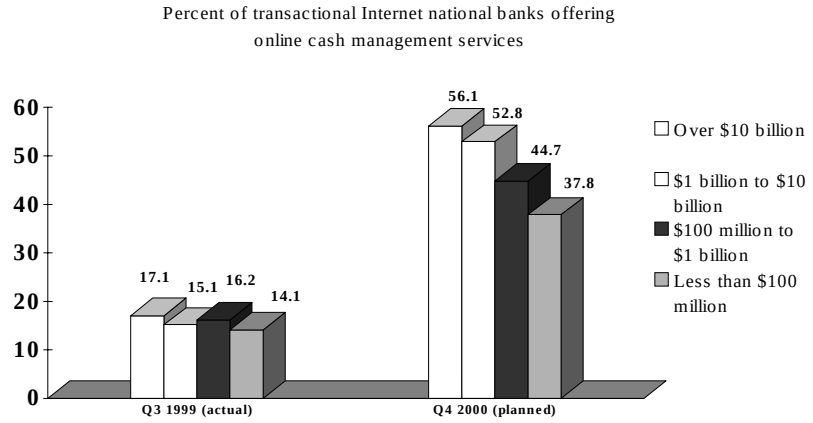
[47] For example, see Bank Technology News (1999c). See Wenninger (1999) for the growing importance of B2B e-commerce.

Figure 5—Biggest percentage increase planned for online cash management, insurance services, and bill presentment



Source: Office of the Comptroller of the Currency

Figure 6—Small banks may lag larger banks in offering business Internet banking



Source: Office of the Comptroller of the Currency

Current and future demand for Internet banking

The level of "demand" for Internet banking in the future is an open question. One interesting aspect to banks' perceptions about future demand is that just under half of all national banks (46.2 percent) had no plans to offer Internet banking. Almost all of the banks without plans to offer Internet banking were in the smallest size category.[48] Clearly, some bankers have questions about how widespread and intense customer demand for Internet banking will be, and about the value of incurring the added expenses associated with offering another delivery channel.[49]

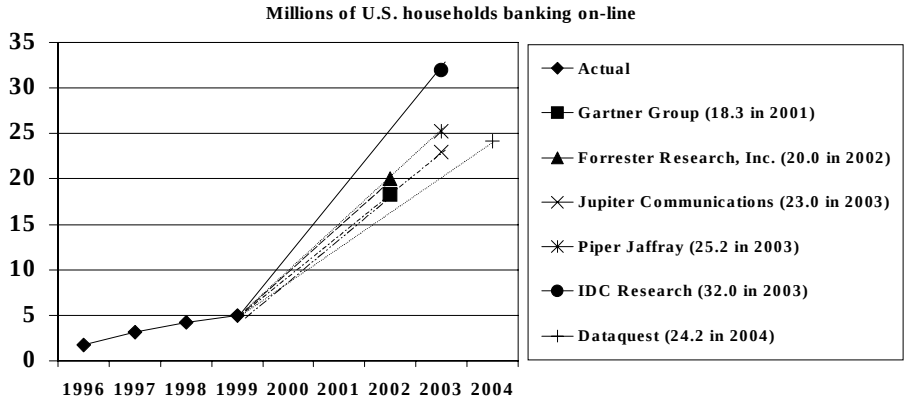
Another perspective on customer demand for Internet banking comes from considering projections about future use made by various industry analysts. Figure 7 shows that number of users of online banking is expected to grow from an estimated 5 million U.S. households in 1999 to as many as 32 million households over the next several years. While that level of usage is substantial, it would represent only about one-third of the 93 million U.S. households with a banking relationship.[50] If those numbers are accurate, only a minority of the household customers of banks currently offering Internet banking or planning to offer it by year-end 2000 would do their banking online.

[48] About 9 percent of national banks planned to offer Internet banking after 2000.

[49] For summaries of a recent survey by Grant Thornton LLP on the Internet banking plans of community banks, see Winig (2000) and Agosta (2000). That survey revealed that 64 percent of the 638 community bank CEOs questioned responded that they expected to offer Internet banking by year-end 2000. The discrepancy between that result and our projections could be due to the inclusion of banks holding assets of more than $100 million in the community banks surveyed by Grant Thornton. It is also possible that community banks are in the process of re-evaluating the desirability of offering Internet banking as more and more competitors go online. Agosta (2000) includes information from the Grant Thornton survey on small bank attitudes toward the Internet. See Carlson (2000) for a discussion of possible reasons some small banks are abstaining from Internet banking.

[50] The Federal Reserve System's 1998 Survey of Consumer Finances (SCF) shows that 9.5 percent of U.S. households did not have any type of transaction account at a financial institution. See Kennickell, Starr-McClure, and Surette (2000).

Figure 7—Industry forecasts of Internet banking



Source: Office of the Comptroller of the Currency using data from various industry sources

Market share of Internet banking customers

Which banks will be the winners and losers in the contest to secure online customers? The Internet is an extremely efficient device for banks of all sizes to collect and manage information. With that information, they will be able to meet the various financial needs of individuals and businesses. For example, they will be able to integrate or "bundle" their services to customers.[51] The Internet also allows financial firms of different sizes, including the smallest banks, to enter markets and reach customers previously beyond them. However, there

[51] It should be noted, however, that data management problems are likely to continue to challenge banks of all sizes. In part this is due to the difficulties of dealing with a variety of customer databases built up over many years. See, e.g., Hallenborg (1999), and Bank Technology News (1999b), which summarizes a study by Innovative Systems Inc. on data management difficulties for banks. See also Horsfield (2000), who reports that an Ernst & Young survey shows that "30% of financial service companies have less than 20% of their systems integrated to show and exchange related customer information across channels and ... 41% believe that customers will not get a consistent answer across electronic delivery channels." In addition, see the *American Banker* (2000b) for a discussion of Speer & Associates studies in November 1999 and March 2000 on how far banks may be lagging behind nonfinancial companies in electronically collecting and using data about customers.

are substantial economies of scale and scope in data storage and data processing, and larger banks are better positioned than small banks to exploit such scale and scope economies than smaller banks. And large banks' greater resources will enable them to fund the advertising and marketing essential to "branding" — making their products stand out from the others.[52]

Industry estimates of the number of customers online at the top five banks are displayed in Table 19.[53] (See Table 19 at the end of the document.) These estimates show the top five Internet banks hold a disproportionate share of Internet banking customers — nearly 36 percent; by comparison, these same five banks accounted for a little more than 20 percent of all small deposit accounts.[54] Indeed, the top two Internet banks together account for almost one-quarter of all Internet banking customers in the United States. And the top five Internet banks' online customers more than doubled in a year and a half (between mid 1998 and the end of 1999). That rate was more than five times the estimate for Internet banking overall in the United States.[55]

Even among the top five Internet banks, however, there is evidence of differences in success at attracting customers to use Internet banking. For example, between mid 1998 and the end of 1999, growth in customer usage varied widely. One bank's Internet banking customer

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[52] See Toonkel (2000c) for a report on Internet banking advertising strategies being employed by several large banks, and estimates from an Ad Relevance Inc. study of the advertising expenditures of three large banks. Some banks are focusing on niche markets or "affinity groups" as an Internet banking strategy. For a report on how several banks are pursuing this strategy, see Weitzman (2000).

For a discussion of the strategic choices facing banks, and the possible consequences of Internet banking choices on banking industry structure and competition, see DeYoung (2000). See also Radecki, Wenninger, and Orlow (1997), Mishkin and Strahan (1999), and Jordan and Katz (1999) for analyses of possible effects of Internet banking and other retail payment system innovations on banking industry structure.

[53] As indicated in the source note in Table 19, the information in the table on Internet banking usage is from industry analysts, not from data supplied by OCC examiners. See especially O'Sullivan (2000b), who summarizes data from a November 1999 survey by Gomez Advisors Inc. on Internet banking usage.

[54] Recent reports and analyses suggest that some banks in other countries have been at least as successful as U.S. banks in securing online customers. For example, see Moody's Investors Service (2000b), Rhoads and Portanger (2000), and Power (2000a and b).

[55] See Figure 7.

base increased by less than 25 percent, while another's increased six-fold. In addition, there is variation in the percent of online customers who are "active", i.e., who use Internet banking at least once a month. At only two of the five Internet banks are more than 50 percent of online customers "active."

VII. Summary and Conclusions

Our analysis indicates several significant differences between the profile of banks that offer Internet banking and that of banks that do not. Broadly speaking, Internet banks rely more on noninterest income and less on deposits for funding than do non-Internet banks. For all but the smallest banks, Internet banks have better accounting efficiency ratios and higher returns on equity than non-Internet banks. Internet banks with assets of less than $100 million had significantly worse accounting efficiency and profitability ratios than non-Internet banks of the same size. Those differences in performance were primarily due to the influence of *de novo* small banks offering Internet banking.

The low percentage of customers using Internet banking, as well as the relatively modest cost of setting up an Internet banking Web site, makes it unlikely that Internet banking is having a sizeable positive or negative impact on the bottom line of most institutions. However, an exception to this generalization might be found among the handful of large banks with a disproportionately large share of Internet banking. And Internet banking may be a primary reason why some small banks, particularly *de novo* institutions, are unprofitable. Some of these institutions may be relying heavily on an Internet-based business strategy, and the full costs of offering Internet banking, while not prohibitive, may be significant for these banks. Further investigation will be needed to determine why *de novo* Internet banks perform poorly and

whether their performance will improve as electronic banking and electronic commerce expand over time.

On the demand side, while only one out of five national banks offered Internet banking as of Q3 1999, our estimates indicate that a large majority of banking customers has accounts with institutions offering Internet banking. Thus, Internet banking could accommodate the sudden, rapid growth that has occurred in other information-intensive industries such as securities brokerage, book selling, and travel. So far, however, bank customers have not been persuaded that Internet banking products and services warrant a substantial change in their banking habits.[56]

There is no doubt that the revolutionary developments in information and communications technology will continue to transform the banking and financial industry. Internet banking, despite the uncertainties about its future, will be an important part of this transformation. This paper attempts to provide a useful picture of the current market for Internet banking, the factors affecting the decision to adopt Internet banking as well as the scope of services offered, and information on banks' plans for the future. We believe this is an important initial step in analyzing the future impact of Internet banking on the banking industry.

[56] Furst, Lang, and Nolle (1998) argue that the likely method of increasing the value added by Internet banking for banking customers is to improve online methods of bundling information. A smooth end-to-end electronic process would eliminate costly paper records of transactions. They also argue that businesses rather than individual households would likely benefit most from such improvements, at least initially.

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Table 13—Safety and soundness, and information technology examination ratings: Internet banks similar to non-Internet banks[a]
(Q3 1999)

	CAMELS ratings[b]		IT ratings[c]	
Asset size category	**Composite**	**Management**	**Composite**	**Management**
Less than $100 million:				
Internet banks	1.72	1.73	1.66	1.81
Non-Internet banks	1.75	1.84	1.81	1.84
p-value	(0.676)	(0.135)	(0.155)	(0.803)
$100 million to less than $1 billion				
Internet banks	1.52	1.58	1.64	1.66
Non-Internet banks	1.63	1.68	1.74	1.77
p-value	(0.009)***	(0.023)***	(0.059)**	(0.055)**
$1 billion to less than $10 billion				
Internet banks	1.50	1.53	1.70	1.80
Non-Internet banks	1.64	1.70	1.61	1.68
p-value	(0.182)	(0.132)	(0.539)	(0.510)
$10 billion and over				
Internet banks	1.63	1.56	1.81	1.89

Source: Office of the Comptroller of the Currency

[a] Numbers in parentheses are probability values (p-values) for a statistical test of the hypothesis that the mean values in each cell are equal. Thus, a smaller p-value indicates a greater likelihood that the true mean value of the Internet sample differs from the non-Internet sample. Asterisks indicate the statistical significance of the difference of means test with:

*** = significant at the 1% level

** = significant at the 5% level

* = significant at the 10% level

[b] CAMELS ratings range from 1 (highest) to 5 (lowest).

[c] IT ratings (Uniform Rating System for Information Technology) range from 1 (highest) to 5 (lowest).

Table 19—Top five Internet banks: estimated growth in number of Internet banking customers, and market shares of online customers

Banking company	Customers using Internet banking				Market shares	
	Second quarter 998	Fourth quarter 999	Growth From second quarter 1998 to fourth quarter 1999 (percent)	Bank's "active" online customers as a percent of bank's total number of on-line customers[a]	Bank's share of all U.S. online banking customers (percent)[b]	Bank's share of all small deposit accounts[c]
Wells Fargo	655,000[d]	1,454,100	122.0	55.7	13.1	5.0
Bank of America	700,000[e]	1,176,600	68.1	46.5	10.6	8.4
Bank One Corp.	144,200[f]	488,400	238.7	47.3	4.4	2.6
Citibank	350,000	432,900	23.7	63.1	3.9	1.4
First Union Corp.	70,000	421,800	502.6	39.9	3.8	3.8
Top five total	1,919,200	3,973,800	107.1	51.1	35.8	21.1

Source: Office of the Comptroller of the Currency using data from Faulkner & Gray (1998); O'Sullivan (2000b); and Federal Financial Institutions Examination Council, Report of Income and Condition (second quarter 1998 and second quarter 1999).

[a] "Active" customers are defined as those who bank online at least once a month.
[b] Fourth quarter 1999.
[c] Second quarter 1999.
[d] For comparability with fourth quarter 1999 figure, includes pre-merger online customers at Norwest bank.
[e] For comparability with fourth quarter 1999 figure, includes pre-merger online customers at NationsBank.
[f] For comparability with fourth quarter 1999 figure, includes pre-merger online customers at First Chicago NBD.