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## **Internet Banking** David VanHoose

**Abstract:** This paper reviews what economists have learned about Internet banking. The paper begins by surveying evidence regarding the fundamental motivations for banks to offer services via the Internet and for their customers to utilize the services. It considers the experience of and future prospects for so-called “pure-play” Internet banks that conduct virtually all dealings with their customers via the Web. The paper next evaluates the current evidence on how Internet banking has affected the performances of traditional banking institutions, with a focus on whether the provision of banking services via the Web has mainly been felt on the revenue or expense side of banks’ income statements. Furthermore, it examines recent concerns about the possibility that deposits raised through Internet channels are potentially more susceptible to sudden withdrawals that could result in runs on banks. The paper concludes by summarizing the main points and considering future directions for research on this topic.

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## **Internet Banking**

### **1. Introduction**

Today, the majority of banks and consumers view banking on the Internet to be an experience as run-of-the-mill as using automated teller machines was for a typical bank customer by the end of the 1980s. Results of a recent Gartner survey [see a summary provided by Hoffman (2009)] of nearly 4,000 U.S. and U.K. banking customers are indicative of the extent to which Web banking is now regarded as just another point of access to banking services. A key inference drawn from the survey is that most people are less interested in modern, flashy-looking Internet banking sites than they are in being able to utilize a basic, secure Web portal for conducting business with their banks.

Across a broad swath of the populaces of developed nations, therefore, banking on the Web is now widely regarded as a relatively mundane activity. Nevertheless, Internet banking has been in existence for only slightly more than a decade, and at most banks the time horizon has been shorter. Thus, only within the past few years have sufficient data become available to gauge the economic effects of Internet banking.

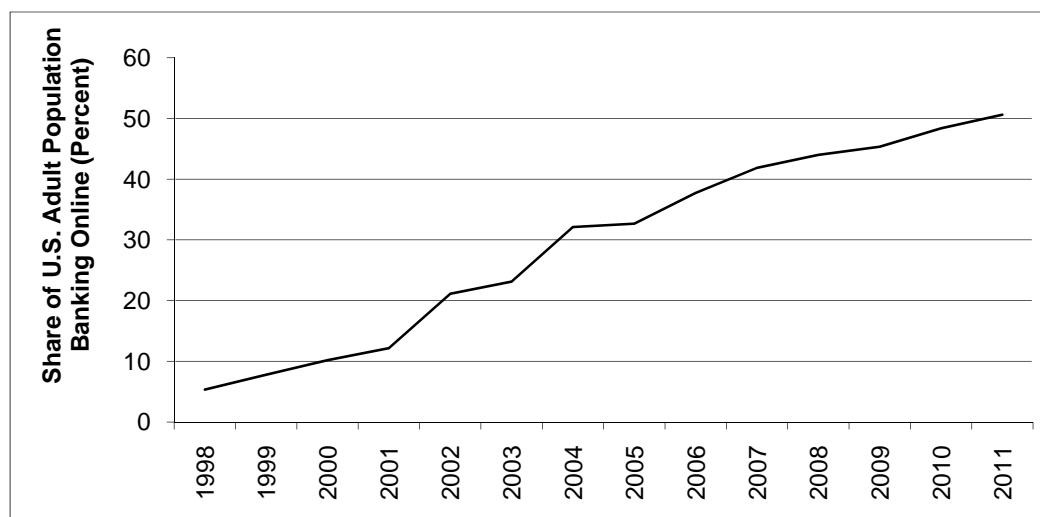
This paper reviews what these data have enabled economists to learn about Internet banking. The paper begins by surveying evidence regarding the fundamental motivations for banks to offer services via the Internet and for their customers to utilize the services. It considers the experience of and future prospects for so-called “pure-play” Internet banks that conduct virtually all dealings with their customers via the Web. The paper next evaluates the current evidence on how Internet banking has affected the performance of traditional banking institutions, with a focus on whether the provision of banking services via the Web has mainly been felt on the

revenue or expense side of banks' income statements. Furthermore, it examines recent concerns about the possibility that deposits raised through Internet channels are potentially more susceptible to sudden withdrawals that could result in runs on banks. The paper concludes by summarizing the main points and considering future directions for research on this topic.

## 2. The Provision of Internet Banking Services

As shown in Figure 1, about half of the U.S. adult population utilizes Internet banking services. What has induced banks to offer innovative services such as these? As Frame and Silber (2004, 2009) discuss, innovations in banking have received only limited study. Silber (1983) suggests that a key reason for banks to engage in this or any other type of innovation in the delivery of financial services is to reduce the effectiveness of both internal constraints—for instance, labor or capital utilization constraints—and external constraints—for instance, market or regulatory constraints—that they face.

**Figure 1: Share of the U.S. Adult Population Engaging in Online Banking**  
[Sources: Pew Internet & American Life Project and Author's Projection]



Bouckaert and Degryse (1995) focus on market constraints in a theoretical analysis of banks' decisions about remote banking services. In the context of a game-theoretic model of spatial competition among banks, Bouckaert and Degryse argue that offering such services has two opposing effects. On one hand, to the extent that the remote banking service induces depositors to hold more accounts or to add to existing accounts, offering the service assists in raising additional deposit funds at current deposit rates. On the other hand, providing the service can reduce depositors' transaction costs of shopping around for other banks offering the same services, thereby bringing a bank into more intense competition with other banks, resulting in upward pressure on deposit rates. Thus, in principle, there are three different possible outcomes: no remote banking services, specialization by some banks in offering the service but not by others, or universal offerings by all banks and a resulting greater intensity of bank competition.

Sullivan and Wang (2005) provide a theory of the diffusion of Internet banking through banking markets. Their model suggests that because larger banks face greater demand for their services, they are more likely to find that adoption of Internet banking provides sufficient cost savings to be justifiable from a profitability perspective. The model predicts that the innovation then diffuses through the industry as market-wide consumer demand for Web services increases, making adoption of these services palatable to progressively smaller banks. Analysis of data from 5,600 state-chartered U.S. banks in 2003 and 2004 provides support for the conclusion that larger banks tend to be first adopters.

Corrocher (2006) finds that among the Italian banks that adopted online banking between 1995 and 2000, banks already exhibiting significant branching intensity were slower to adopt Web banking than those with few

branches in place. This result suggests that the specialization outcome predicted by Bouckaert and Degryse arose in Italy during this period, with banks already possessing branch networks opting not to add to the intensity of competition for existing deposits while, as Corrocher emphasizes, banks lacking branches used Web banking services to attract new depositors.

In an examination of a 1999 sample of more than 1,600 U.S. banks, however, Courchane et al. (2002) find that larger banks with growing market shares—and hence in most cases presumably larger branching networks—are more likely to put into place transactional Web banking sites, a conclusion generally consistent with those obtained by Sullivan (2000) in a study of early Internet adoptions by Tenth Federal Reserve District banks and by Sullivan and Wang (2005) in their nationwide study of state banks. Nevertheless, Courchane et. al. also conclude that a bank's presence in a market exhibiting greater concentration leads to a reduced likelihood of online banking implementation. A possible interpretation of these results is that a bank gaining ascendancy in a market is more likely to choose to do so in part by adding another remote channel, whereas a bank already participating in a heavily concentrated market has less incentive to try to increase the intensity of competition.

Hernández-Murillo et al. (2009) use quarterly data from all U.S. commercial banks over the 2002-2006 interval to consider a broadened set of potential factors influencing banks' decisions to offer transactional Web sites. They likewise find that large institutions are more likely to utilize Internet banking. In addition, they find evidence that the decision to adopt Web technologies is more likely at banks with lower shares of non-performing loans, lower returns on assets, and a higher ratio of loans to total assets. Furthermore, Hernández-Murillo et al. provide evidence that market

concentration is a key determinant: a smaller value of the average Herfindahl-Hirschman index (the sum of squared shares of all banks in a market, derived from the Cassidi database of the Federal Reserve Bank of St. Louis) is associated with a higher rate of adoption of online banking technologies. This relationship, they suggest, indicates that greater competitive pressure contributes to the adoption of Internet banking.

Indeed, based on a study of 701 retail customers of one financial institution, Sciglimpaglia and Ely (2006) find evidence of considerable competitive effects associated with online banking. They conclude that banking institutions lacking transactional Web sites are highly vulnerable to competition from those that do.

Corvoisier and Gropp (2009) also examine the competitive implications of Internet banking. They suggest that an important impact has been to reduce sunk costs, thereby making banking markets more open to both potential and actual entry. A consequence, they theorize, should be a tendency for greater Internet penetration within a geographic banking market to push down banks' loan and deposit interest margins—where the former relates the loan rate to a money market rate and the latter relates the deposit rate to the same money market rate. Based on analysis of data from more than 3000 banking institutions in nine eurozone nations over the 1995-2003 period, Corvoisier and Gropp find evidence that greater Internet penetration reduces the deposit interest margin, but not the loan interest margin. Corvoisier and Gropp conclude, therefore, that greater Internet penetration tends to introduce more potential and actual entry into deposit markets, but not necessarily into loan markets.

There have been relatively few carefully done studies of the key determinants of consumers' adoption of online banking technologies. Most

published work focuses on factors most obviously likely to be positively related to utilization of Internet banking. There is, for instance, considerable evidence that people with higher incomes and more education are more likely to utilize computing technology more frequently and, hence, contemplate Web banking. In addition, greater Internet access rates are also associated with usage of Web banking channels.

Only Bauer and Hein (2006) seek to provide an economic analysis of key determinants. They contemplate how attitude toward risks affects a consumer's decision to adopt Internet banking. In the context of a utility-theoretic framework, Bauer and Hein determine that the consumer's adoption decision is determined by interaction among three key factors—the certainty-equivalent addition to utility that the consumer perceives from availability of a new banking technology, which depends positively on familiarity with the technology; the cost of the technology in relation to the consumer's income; and a risk premium driven by consumer uncertainty about the technology. They suggest two sources of consumer uncertainty: the potential for unauthorized access and the possibility that the technology will prove difficult to implement.

Bauer and Hein utilize data from the Federal Reserve's Survey of Consumer Finances, including a set of survey questions regarding attitudes toward risk, to study the roles of perceived certainty-equivalent utility gains, cost in relation to income, and the risk premium in determining relative importance in decisions about adopting both phone banking and online banking. Bauer and Hein verify for both technologies that greater familiarity with the technologies and higher incomes are associated with greater adoption and that higher risk aversion is related to a negative adoption decision.

Bauer and Hein discover that a very important element in both the phone-banking and online-banking adoption decisions is a consumer's age. Older individuals are significantly less likely to adopt the new technologies than younger individuals, which is consistent with a higher human-capital cost in relation to stream of anticipated returns for older consumers. They find, in addition, that either an older or younger consumers who has adopted either phone banking or online banking is more likely to adopt the other technology. These results, Bauer and Hein conclude, suggest that efforts on the part of banks to educate consumers about new banking technologies such as online banking are more likely to be successful if focused primarily on younger individuals and on people who already have adopted a relatively new technology.

Consequently, there is some evidence that large institutions in growing markets have been particularly likely to offer online banking channels. Nevertheless, the evidence suggests that market constraints do much to explain why so many banks have opted to provide Internet banking services. Competitive pressures have made banks vulnerable to loss of market share to rivals offering Web banking, which has induced responses that have contributed to broader offerings of online channels across the banking industry. The single economic study examining the main factors giving incentives to consumers to utilize online banking services concludes that people who are already relatively "technology savvy" are most likely to utilize online banking. At present, this group consists mainly of older individuals who have kept in touch with technological developments and younger people for whom such developments are part of everyday life. This finding suggests that the share of the adult population engaged in online banking is likely to continue to increase over time. The rate of

increase is likely to be more gradual than in prior years, however.

### **3. Performance of Pure-Play Internet Banks**

As noted above, Bouckaert and Degryse's (1995) theoretical analysis suggested that one possible outcome when a new remote banking channel becomes available is specialization by some banks. To some extent, this outcome has indeed materialized in the form of so-called "pure-play," or Internet-only (or nearly Internet-only) banks. These are institutions that operate largely online—with very few physical branches or in instances with only a home office.

The initial promise of the pure-play banking model was that such banks would experience lower per-unit costs in the form of lower fixed costs—hardly any physical branches—and perhaps even reduced variable operating expenses. Indeed, during the dot-com boom of the late 1990s, some observers anticipated that the cost advantage of the pure-play Internet-banking model would lead to explosive growth in this area of bank specialization. Ultimately, however, the time path of this banking niche appears as a lag on the dot-com bubble. Dozens of Internet-only banks entered at the outset. Several of these institutions ultimately exited the marketplace. A few switched to a more traditional mode of operations by establishing several physical branches. Nevertheless, several institutions appear to have established a long-run niche as pure-play online banks.

Dandapani and Lawrence (2008) contrast the 1998-2006 performances of 17 Internet-only banks that have maintained active positions in the marketplace with the performances of 11 failed Internet-only and 31 failed traditional bricks-and-mortar banks. They find that the active Internet-only banks exhibited interest- and non-interest income and interest-expense

performances similar to those of failed Internet-only banks. The active Internet-only banks were significantly more efficient with regard to non-interest expenses than were failed Internet-only banks, however. Dandapani and Lawrence also find that the failed bricks-and-mortar banks possessed significantly poorer-quality assets, whereas higher non-interest expenses again stood out more prominently at the failed Internet-only banks. Thus, Dandapani and Lawrence's analysis indicates that unsuccessful Internet-only banks tend to lack the management expertise to control non-interest expenses. Their market exits, therefore, resulted primarily as a consequence of unprofitable operations rather than insolvencies.

These conclusions are consistent with those of DeYoung (2005), who for the 1997-2001 period contrasts the performances of a dozen Internet-only depository-institution startups with a sample of 644 traditional bricks-and-mortar institutions that began operations during the same interval. DeYoung concludes that non-interest expenses are significantly higher at Internet-only depository institutions. DeYoung's estimates indicate that, as compared with a traditional institution, a typical Internet-only institution hired about 50 more full-time-equivalent employees and paid each one an annual salary approximately \$12,000 higher. DeYoung (2001) also finds evidence of higher overhead costs at Internet-only institutions.

DeYoung (2001) also provides evidence that Internet-only institutions grow more rapidly than traditional institutions. DeYoung (2005) finds no evidence that learning-by-doing gains are any higher at Internet-only institutions, but he finds that an increase in the scale of operations of Internet-only institutions generates greater performance improvements at Internet-only institutions as compared with traditional institutions—though

the earnings performances of Internet-only institutions tends to lag behind those of traditional institutions.

Delgado et al. (2007) reach conclusions very similar to those of DeYoung (2005) in an analysis of data for 15 primarily Internet banking institutions and 45 traditional banks in Europe during the 1994-2002 interval. They find evidence, however, of even greater scale-efficiency effects at Internet-only banks based in Europe.

Thus, available evidence suggests that initial optimism regarding potential cost efficiency advantages of the pure-play, Internet-only banking model was misplaced. A number of pure-play entrants actually struggled to control non-interest expenses—unsuccessfully in several instances. It appears that the Internet-only institutions that have succeeded in attaining no more than perhaps slight cost-efficiency advantages over traditional rivals.

#### **4. Internet Banking at Traditional Institutions: Cost Efficiencies Versus Revenue Enhancements**

How did the first traditional institutions that offered online services perform? Sullivan (2000) provided one of the first studies of performance effects of Internet banking in a study of the use of this channel by banks within the Tenth Federal Reserve District. He found no evidence that banks adopting Internet channel were any riskier. These banks tended to experience higher non-interest expenses, but their profits were no lower than those opting not to adopt Web banking.

Furst et al. (2002) examine data collected in 1999 for more than 2,500 national banks. Of these, nearly 20 percent were at that time offering transactional Internet banking services—most commonly account balance

inquiries, bill payments, and credit applications, but also including various new account, brokerage, cash management, bill presentment, and insurance services. Among the banks analyzed by Furst et al., those that were first to begin offering online transactional services were less likely to be profitable compared with all other banks. In general, smaller institutions that adopted Internet banking after the middle of 1998 were likely to be equally profitable, while larger institutions that began offering online banking after that date tended to earn higher profits.

DeYoung et al. (2007) compare the 1999-2001 performances of 424 community banks that adopted transactional Web sites to the performances of more than 5,000 community banks that relied solely on bricks-and-mortar branches. They find evidence that institutions offering Web banking utilized their Internet links to customers as complements to physical branches rather than as substitutes. DeYoung et al. conclude that in spite of higher wage expenses these banks incurred, they earned relatively higher profits generated by more-than-compensating higher revenues derived from additional deposit service-fee income. DeYoung et al. also find evidence that community banks offering customers Internet access experienced liability reallocations from checkable deposits to money market accounts. Additionally, these banks experienced shifts to more brokered deposits. There were no discernable asset effects of Internet banking.

Recent studies have also examined performance effects of online-service offerings of banks in nations other than the United States. Ciciretti et al. (2009) study the performance of 105 Italian banks during the 1993-2005 period. Ciciretti et al. find evidence that banks offering online banking have stronger performance than those that do not, but they do not seek to determine which direction the causality runs; they find a hint of evidence

that online activities may be associated with somewhat less risk. Hernando and Nieto (2007) evaluate the performance effects of Internet banking in a study of 72 Spanish commercial banks during the 1994-2002 interval. These researchers find that larger Spanish banks have been more likely to adopt Internet banking. Consistent with DeYoung et al., Hernando and Nieto conclude that banks use transactional Web sites as complements to branch networks. Nevertheless, in contrast to DeYoung et al., Hernando and Nieto find evidence that within three years after adoption, Internet banking generates lower overhead and staff expenses for banks that contribute to profitability improvements.

Dandapani et al. (2008) examine how offering Web-based services affected the performance of U.S. credit unions, of which the share offering online services rose from 25 percent in 1999 to 64 percent in 2006. They provide evidence that the provision of online services tends to boost credit union's operating expenses. Credit unions that offered online-banking arrangements were generally as profitable as those that did not, suggesting that revenue gains generated by providing Internet services compensated for the higher costs.

Dow (2007) also studies adoption of online transactional services at credit unions. He examines National Credit Union Administration Call Report data from 2000 and 2003 for more than 9,300 institutions. Dow finds that scale is the main factor determining whether credit unions adopt Internet banking, with larger institutions more likely to do so and also prone to utilize more advanced versions of online transactional technologies. Perhaps as a consequence of the increased expense associated with implementing Web technologies, another of Dow's findings is that interest rate spreads offered by credit unions using transactional Web sites are less

favorable compared with credit unions that do not.

In contrast to the conclusions of Dandapani et al. and Dow regarding performance effects of transactional Internet accounts for U.S. credit unions, Sathye (2005) concludes that there are almost no discernable impacts among a set of 62 Australian credit unions, of which 44 offered transactional sites to customers. The only performance effect Sathye finds is an increase in the credit risk exposure of credit unions offering online services.

Clearly, the conclusions of these studies of performances of traditional banks offering Internet-based services are somewhat mixed. To the extent that researchers find evidence of impacts on expenses, these tend to be positive in the short run and negative over the longer term. This pattern suggests that banks may learn by doing—see Sullivan (2001) for a discussion—resulting initially in relatively higher per-unit costs but realization of cost efficiencies after gaining greater experience with Internet channels. There is less evidence of significant revenue enhancements, although the fact that initial profitability effects tend to be minimal or even positive in the face of initial cost increases suggests that revenues at least rise sufficiently to compensate for higher costs.

## **5. Are Internet Banks Less Stable? The Case of Ally Bank**

From the earliest days of Internet banking, some observers have expressed concerns about an allegedly heightened potential for banking fraud to occur online. Indeed, some outright fraud has taken place. For instance, in 1997 a company located in a small North Carolina community launched Web-based deposit-taking operations over the Internet and claimed that its deposits were backed by a policy issued by a major insurance company. The fledgling virtual bank promised to pay annual

interest rates up to 20 percent on savings accounts and 10 percent on checking accounts and said that it would make loans “with no credit checks” to small businesses at one to two percentage points above the prime rate. Ultimately, however, the Federal Trade Commission halted the new company’s unlicensed “banking” operations within days after they began.

Even licensed banking institutions relying on the Web operations have run afoul of regulators. In 1998, for example, the Federal Deposit Insurance Corporation seized Kentucky-based BestBank, which had a single office with fewer than two dozen employees and raised many of its deposits on the Internet. In the preceding several years, BestBank’s low-cost operations had made it five times more profitable than the average U.S. bank. So had the fact that a portion of its lending occurred via issuance of a half-million credit cards with \$600 borrowing limits but with a precondition for the cardholder join a Florida-based travel company at a fee of \$543, which the bank charged to each cardholder’s account before sending out the card, leaving only \$57 of available credit. When the bulk of these cardholders failed to pay off their loan balances, the bank found itself with liabilities exceeding assets by nearly \$100 million, resulting in FDIC seizure.

Does the availability of Internet channels give today’s financial institutions incentives to replicate the business model of the so-called “wildcat banks” – so named because wildcat banks allegedly over-issued deposits and protected themselves from runs by placing offices in remote locales where “only wildcats roamed” – of the nineteenth century? On the one hand, as recently as 2009, press reports have suggested that the answer is yes. The specific situation in question in 2009 involves GMAC’s Internet-only institution, Ally Bank, which some observers recently have alleged has utilized its Web presence to engage in especially risky practices. According

to Fitzpatrick and Paletta (2009), for instance, interviews with regulatory officials suggest that

...FDIC officials get nervous when banks offer extremely high interest rates, particularly when it is done over the Internet, where customers don't have loyalty to any bank branch. The deposits are seen as "hot," or volatile. Depositors who flock to a bank for the rates might just as quickly desert it if a better deal appears elsewhere. That could lead to the equivalent of a cyber bank run.

According to this perspective, not previously raised by FDIC officials or other financial regulators, banks relying relatively more on Internet channels are less safe than traditional banks. Like the so-called nineteenth-century wildcat banks, they over-issue deposits by promising to pay high rates of return. Unlike wildcat banks, however, Internet-heavy banks cannot hide, because their Web sites are readily accessible, implying that from a regulatory perspective – at least, based on the above quote – they are even less safe.

On the other hand, none of the research discussed above finds substantial differences in the performances of banks based on availability of Web banking. Theoretical and empirical economic analysis, therefore, suggests that the answer to the wildcat-banking question is no.

Indeed, the available evidence comparing institutions offering Web banking to those that do not suggests that the fact that Ally Bank is an Internet-only bank is a red herring. The fundamental issue with respect to Ally Bank's situation is that the government owns more than one third of the shares of GMAC. To date, the FDIC has provided guarantees for up to \$7.4 billion of GMAC debt. The federal government has provided the GMAC bank holding company more than \$12 billion in loans and capital

funding—a total amount exceeding 20 percent of Ally Bank’s total assets.

Consider how the U.S. government’s relationship with GMAC is analogous to a situation involving the German government and German auto firms. Like the U.S. government, in response to the 2008 panic the German government guaranteed deposits at all banks. This made deposits at German automakers’ banking subsidiaries as safe—from depositors’ point of view—as any others. In addition, the German government gave special subsidies to auto manufacturers. The auto makers, in turn, directed that a portion of these funds be used for payment of higher rates of interest on deposits than the rates offered by traditional institutions, thereby providing more funds to finance relatively high-risk (particularly during the recent recession) auto loans. As a consequence, even as Germany’s auto sales declined in 2009, savers began shifting funds from traditional banks to the banking subsidiaries of German automakers. Between November 2008 and March 2009, deposits increased at Mercedes-Benz Bank by more than 100 percent and at Volkswagen’s banking by more than 70 percent (*Economist*, 2009).

The U.S. government’s subsidies and guarantees to GMAC are several orders of magnitude greater than those the German government has provided to banking arms of German auto manufacturers. The underlying issue with respect to Ally Bank is its access to these government funds and guarantees, which have created a moral hazard exposure that goes beyond the standard moral hazard problem associated with deposit insurance. Indeed, Ally’s explicit government guarantees create a situation in which the bank potentially has an incentive to pay an above-market rate of return on deposits in an effort to expand its balance sheet. Ally can then gamble on assets offering higher returns as a consequence of higher risks, because such

a large portion of the risks are borne by U.S. taxpayers. Thus, managers of Ally Bank arguably have considerable incentive to seek to obtain deposits at rates higher than those that unsubsidized competitors stand ready to offer. Although Ally's ex-chief executive officer recently stated [Fitzpatrick and Paletta, 2009] "allow us to make money and allow savers to get just a little bit more from their savings," the fundamental issue faced by taxpayers is the risk structure of Ally Bank's asset portfolio funded by taxpayer-provided capital, loans, and deposit and other debt guarantees.

Indeed, Ally Bank has not been the only recipient of taxpayer funds to offer relatively high deposit rates. In recent months, AIG Bank, the banking subsidiary of American International Group that to date has received more than \$180 billion of taxpayer-provided funding, has also paid deposit rates toward the upper end of the national rate distribution. Recently, however, the FDIC has pressured some banks receiving federal assistance to reduce their deposit rates. Among those the FDIC pressured to reduce deposit rates was Ally Bank, which agreed – after receiving the FDIC's debt guarantee – to keep its deposit rates below those offered by the five banks offering the highest rates in the nation.

Beginning January 1, 2010, the FDIC will limit the deposit rates of banks judged not to be well capitalized to be no higher than 75 basis points above national average rates (Federal Deposit Insurance Corporation, 2009). Interestingly, however, this rule likely will not apply to Ally Bank. Under current enforcement of U.S. bank capitalization standards, federal capital injections – including a potentially additional injection that Ally Bank may receive before the end of this year – enable the bank to meet the "well capitalized" standard. Thus, unless the FDIC applies further pressure specifically to Ally Bank or the formal definition of "well capitalized"

changes, Ally Bank will be unaffected by the new deposit rate rule.

Does it matter at all that Ally Bank raises all of its funds on the Internet? Research to date suggests that a reliance on Internet channels does not lead either to worse performance or to a greater likelihood of failure, as compared with traditional banking institutions. Indeed, if bank regulators were truly worried about Ally Bank's status as an Internet-only institution, presumably they would also be taking action against other Web-based banks, such as EverBank and ING Direct, that have offered deposit rates close to those of Ally Bank in recent months. The truly substantive regulatory issue associated with Ally Bank is its access to significant government subsidies and the resulting exposure of U.S. taxpayers to associated moral hazard risks, not its status as an Internet-based banking institution.

## **6. Conclusions and Suggestions for Future Research**

Internet banking came of age during the past decade. Most evidence indicates that traditional financial institutions that have adopted Internet banking have done so for competitive reasons. Aside from the most obvious factors motivating customer adoption of Web banking, such as income and Internet access, relative youth and familiarity with recent technologies are key determinants.

Performance implications of Internet banking have been relatively modest. There is evidence that adoption of Web banking channels initially boosts per-unit expenses—leading to higher post-adoption costs for traditional institutions and greater-than-anticipated preliminary costs for pure-play, Internet-only banks—followed by lower per-unit expenses when banks become more proficient. There is limited evidence that Internet

banking may reduce banks' sunk costs, which may encourage more entry into banking markets, other things being equal. So far, available evidence suggests perhaps some revenue-enhancement impacts, which for most institutions appear to have been at least sufficient to compensate for the initially higher costs associated with Web banking. Initially, the availability of Web channels spawned a limited number of episodes involving fraudulent activities, but since the late 1990s there is no evidence that Internet banking makes banks any less safe or sound. Certainly, there is little support for recent suggestions that Internet-only banks are less safe than traditional institutions, in spite of press accounts indicating regulator concerns about this possibility. In the recently highlighted case of Ally Bank, the substantive issue of concern is a moral hazard problem arising from the bank's heavy reliance on government financial support.

What issues remain open for research in the area of Internet banking? Obviously, as bank and consumer adoption rates gradually continue to grow, more data should become available to evaluate the performance impacts on both pure-play and traditional banking institutions.

One relatively unexplored area, however, is interrelationships between banks' offerings of Internet channels and efforts by more than 600 banks to date [see Worthen (2009)] to promote mobile banking. Presumably the two banking channels should involve self-reinforcing complementarities, but to date no studies have explored the extent of such complementarities.

Another unexplored topic is the extent to which banks might be able to couple Internet channels with network effects—the potential for a customer's valuation of a service to increase as utilization rates by others increase. There are two ways in which banks might be able to relate Internet

banking technologies to services subject to network effects. First, network effects could arise through linkage to their credit card operations. Many banks already fold data on credit and debit card transactions and link transactional card services into existing Internet-banking operations. It is already well known that bank card operations involve network effects that arise from the two-sided nature of bank payment card networks [see VanHoose (2009a, b)]. Cardholders benefit when more consumers utilize the bank cards that they carry, because this increases that likelihood that retailers will accept cards, and banks issuing the cards benefit for the same reason. So far, there have been no studies examining the extent to which banks may have been able to benefit from network effects that might arise from the complementary nature of Internet banking services and the credit and debit card account services that they offer.

Second, network effects could arise through another Internet-based—and two-sided—channel, online social networks. As discussed by Bills (2009), bankers have only begun to explore the potential of social networks for their business. Certainly, there have not been any attempts yet to develop ways for customers to enable third-party payments via Facebook or MySpace pages or to order up payment transfers via Twitter messages. Nevertheless, in light of network effects associated with social networking, such future forms of online banking activities may not be far-fetched, and consequently may be worthy of consideration by economists.

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