Does Internet Banking Affect the Performance of Community Banks?

Albert Kagan
Ram N. Acharya
L. S. Rao
Vinod Kodepaka

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Professor, Assistant Research Professor, and Graduate Students, Morrison School of Agribusiness and Resource Management, Arizona State University, Mesa, AZ 85212.

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A structural equation model was used to develop an online banking index and the index was included in an econometric model to examine whether the index explains differences in community bank performance. The results show that banks that provide extensive online banking services tend to perform better than those who lag behind. Results show that online banking helps community banks improve their earning ability as measured by return on equity and improve asset quality by reducing the proportion of overdue or under performing assets.

Key words: online banking index, structural equation modeling, bank performance

Community banks have traditionally maintained a degree of strategic advantage over direct banking competition. The competition within the community bank sector has been typically geographically centered to a specific community. This has allowed the financial institution to establish a strong knowledge base of local business requirements and develop products and services that were oriented towards the local community. Additionally the well defined business and lending practices led to a relationship banking environment that continued to foster the local comparative advantage. This was a key component of a strong rural infrastructure that augments community development.

Given that the customer profile of the community bank tended to be that of small to medium sized businesses and agricultural firms (when present) within a relatively under served capital market location the comparative advantage position could be fostered and maintained. This comparative advantage seemed to be evident given the unique aspects of local business, overall economic performance within the community and the relative lack of direct competition. The mantra of relationship banking seems to allow the community bankers to better evaluate the financial needs and requirements of local firms which appear to support community development activities.

Recent changes within the banking sector and in particular the community bank segment are fostering a different view of community banks as Internet banking continues to expand. The completion of banking deregulation, cost reductions in lending applications, innovative use of electronic banking products and a shift in competitive focus beyond geographically isolated financial markets have set the stage for a changing structure of community banks. This has increased the competition in the small business lending markets, which used to be mainly served by the local banks. (Beck, 2001; Foster, 2001).

Community banks will have to compete in the market place by introducing new banking products and services that have greater appeal to a changing customer base (Simpson, 2002; Brewer, 2001). Electronic banking services, such as online banking could be one of the alternatives (Gupta and Collins, 1997). Currently the majority of electronic banking services are delivered by large regional and national banks. Community banks, on the other hand, have not been as aggressive in orienting their implementation within the on-line banking arena (Emmons and Greenbaum, 1996). A key facet of Internet activities within the banking sector must be driven by service quality that augments the traditional banking relationship (Jun and Cai, 2001). This places added pressure upon local banks to be efficient in delivering community development applications.

This study examines the impact of online banking applications on community bank performance. Since online banking was not available, individual bank websites were analyzed and evaluated for 97 different web features and services offered online. Then a structural equation modeling framework was used to create a comprehensive banking index. This online banking index was used to evaluate whether banks with higher index value perform better than

those with lower values. The results show that online banking helps banks in improving performance both in terms of earnings ratio as well as asset quality.

Supporting Literature

A component of community banking effectiveness has to be the financial institutions response(s) to online banking applications and the changing nature of competition. Various studies have been undertaken to understand the direction and focus of Internet banking (Furst, Lang, and Nolle 2000; Courchane, Nickerson and Sullivan 2002; Acharya and Kagan, 2004.). To date there has been limited information as to the impact of electronic banking activities and practices upon the community banking sector and the interaction to community business development.

The traditional environment of community banking relied on a substantial set of federal and state banking regulations that shielded local banks from outside competition, prevented the entry of other financial institutions into traditional community banking markets and prevented price competition among banks for transactional deposits. Market conditions as well as financial and technological innovations along with a deregulation thought process during the last twenty five years has led to the reduction of banking regulations, eliminated non competitive market entrants and brought an end to the isolated world of community banks. This new competitive format has jolted community banks from their comfort zone (DeYoung, Hunter and Udell, 2004).

During the 1990s a widespread adoption of new financial and informational technologies by almost all US banks was implemented. These technological advances have increased the competitive pressure on community banks. New financial tools such as mutual funds, money market funds (MMF) and online brokerage activities have provided attractive

investment options for depositors, and as a result core deposits have become less available for all size classes of banks (Genay, 2000). Because community banks have fewer non-deposit funding options than large banks, it costs community banks more to attract and retain core deposits. New financial instruments, combined with improved information about borrower creditworthiness, have intensified competition on the asset side of banks balance sheet.

It is quite possible that the biggest impact of technology upon the banking system may have been the adoption of the electronic payment system (DeYoung, Hunter and Udell, 2004). The increased efficiency that results from shifting from paper based to electronic payments will reduce the amount of transactions required by consumers. Gerdes and Walton (2002) found that the number of checks paid during the second half of the 1990s was falling at a rate of about 3 percent per year while credit card payments and debit card payments were increasing during this period by 7.3 percent per year and 33.6 percent per year respectively. Humphrey *et al*. (2001) indicates that the share of check payments has been declining from 1990 to 2000. The share of payments by check to total payments has fallen from 87.8 percent to 72.3 percent during this time period. Consistent with the increasing presence of technology adoption within the banking sector is the use of the automatic clearing house (ACH). The ACH is used for regular payments such as monthly mortgages, direct deposits and other scheduled payments. ACH volume handled by the Federal Reserve increased at a 14.2 percent annual rate from 1990 to 2000 (Berger *et al*. 1999). The use of automated teller machine (ATM) has revolutionized bank delivery systems by increased customer convenience, enhanced revenue generation via ATM fees and has allowed for the immediate access of customer funds.

US commercial banking system has always been a highly information sensitive in delivery activities that relies heavily on information technology (IT) to acquire, process, and

deliver the information to all relevant users (Tan and Teo, 2000). Not only is IT critical in the processing of information, it provides a process for the banks to differentiate product and service offerings. Driven by the challenge to expand and capture a larger share of the banking market, some banks have invested in more brick and mortar locations to enlarge their geographic and market coverage, while others have considered a new approach to deliver their banking services via a new medium, the Internet.

Internet banking allows customers to perform a wide range of banking transactions electronically via the bank's Web site. When first introduced, Internet banking was used mainly as an informational medium in which banks marketed their products and services on their Web sites. With the development of secured transaction technologies, more banks are using Internet banking as a transactional as well as an informational medium. As a result Internet banking users can now perform common banking transactions such as writing checks, paying bills, transferring funds, printing statements and checking account balances online using a computer (Acharya and Kagan, 2004).

The increased efficiency that results from shifting from paper based to electronic payments will reduce the amount of transactions required by consumers. Consequently the shift from full service banking offices to more specialized delivery channels will streamline banking services as well. With the rapid diffusion of the Internet to all customer levels, banking online is fast becoming an alternate channel to provide banking services and products. It is believed that, in the future, Internet banking will continue to increase in importance as a strategic application and will become a competitive necessity that must be adopted by financial institutions to remain in the banking sector (Bradley and Stewart, 2003).

This study examines the impact of online banking applications on bank performance. An evaluation of banking products and services from a representative sample of community banks across the upper Midwest is the target population of this study. Given that the upper Midwest and Texas contain the largest number of community banks the study is focused on performance issues derived within this banking segment.

Methodology

This study uses a structural equation model (SEM) to create online banking index and an econometric model to evaluate bank performance. The first part of the methodology involves identification of website features and services offered by community banks online. An initial survey of ten community banks identified 97 website features and services offered by the banks that were deemed important and supported by the literature. Once the pilot study was considered acceptable, all community banks with total assets less than one billion dollars and operating in Iowa, Minnesota, Montana, North Dakota, and South Dakota were identified. This process identified 1183 banks in total. Out of these 1183 banks, only 797 had a website as of November 2004. Each bank website was evaluated to identify how many of the 97 website features and services were being offered by the bank online.

Using the bank website layout (map) and business 2 business (B2B) ecommerce literature as a guide, these 97 variables were grouped together in 10 different groupings (a preliminary correlation analysis and exploratory factor analysis supported these groupings - results not reported). Each item within these groups was summed to create an aggregate index and these indices were used in the structural equation model as latent indicators for three latent constructs identified as: general information, banking services, and core banking services. The

structural equation model used in creating the online banking index is summarized in the next section.

Structural Equation Model

The structural equation model consists of two parts – a measurement model and a structural equation model. Following Muthen's specification, a general structural equation model can be specified as

$$\eta = \alpha + \beta\eta + \Gamma\xi + \varsigma$$

the measurement models are specified as

$$y = \Lambda_y \eta + \varepsilon$$

$$x = \Lambda_x \xi + \delta$$

where *α(mx1)* is a parameter vector of intercepts; *β(mxm)* is the matrix of coefficients for the regressions among the endogenous variables (η_i), which has zeros in diagonal and (*I*- *β*) is non-singular; *Γ(mxn)* is a matrix of coefficients of exogenous latent variables (ξ) in the structural relationship; and ζ is a random vector of residuals; *y(px1)* is a vector of observed response or outcome variables; *x(qx1)* is a vector of predictors, covariates, or input variables. The vectors *ε(px1)* and *δ(qx1)* are measurement errors in y and x, respectively. Since both of the latent variables *(η* and ξ) are not observed, the observed response variables y and x are used to estimate factor loading (Λ_y and Λ_x) on these latent variables (Muthen).

In this framework, the structural equation model used in creating the online banking index involves two dependent latent constructs, η_1 (Banking services) and η_2 (Core Banking Services) and one independent latent construct ξ (General Information). Each of these three latent constructs is measured using three indicators (see table 1). For instance, the latent construct "Core Banking Services" is measured using "Commercial Loans", "Residential Real

Estate Loans", and "Personal Banking" latent indicators. The latent construct η_2 is hypothesized to be determined (caused) by other two latent variables η_1 and ξ. Thus the dependent latent construct η_2 reflects the impact of all bank website features and online banking services and provides a comprehensive online banking index. This index is used to examine the impact of online banking on two of the bank performance measures - return on equity (ROE) and asset quality (proportion of overdue assets).

A community bank's return on equity (Y_i) can be defined as a function of factors associated with loan structure such as business loans to total loans ratio (B_{lon}) and consumer loans to total loans (C_{lon}). Other factors concerning bank performance include fixed assets to total asset ratio (F_{aset}) average rate of growth in assets (A_{gr}); total assets per employee (A_{emp}), employment growth rate (E_{gr}), share of non-interest income on total expenses (NI_{ex}), level of inefficiency as measured by non-interest expenses to total revenue (NE_{rev}), liabilities to asset ratio (L_{ast}), net interest margin (I_{mg}) banking index, and online banking index (B_{indx}), i.e.,

$$Y_i = \alpha + \beta_1 F_{Inc} + \beta_2 B_{lon} + \beta_3 C_{lon} + \beta_4 E_{qcap} + \beta_5 NI_{ex} + \beta_6 NE_{rev} + \beta_7 L_{ast}$$

$$+ \beta_8 A_{emp} + \beta_9 I_{mgn} + \beta_{10} A_{gr} + \beta_{11} E_{gr} + \beta_{12} B_{indx} + \varepsilon_i$$

Similarly, an econometric model for proportion of overdue assets can be specified as a function of the explanatory variables included in the return on asset equation. However two variables - proportion of business loans to total loans and consumer loans to total loans - were excluded from the model system to avoid a simultaneity problem (see table 5 for complete listing of variables).

Results

The variables measuring a community banks' website features and online banking services that were used in the structural equation model are listed in table 1. The first column shows the three latent constructs developed in the structural equation model. The second column provides the Cronbach α values for each latent construct. All three values are very high indicating that the latent indicators used in the analysis provide a consistent measure of the latent constructs.

The latent indicators are listed in the third column of table 1 and their respective coefficient alpha values are reported in the fourth column. All alpha values are greater than 0.7 except for the indicator "community information." Although this latent variable does not meet the general rule of thumb criteria widely used in determining the internal consistency of latent constructs, the community information variable was deemed important in determining online banking services and subsequently was used as an indicator. The fifth column reports variables used to measure website features and banking services offered by banks online. Out of the original 97 variables used to analyze bank's website, only 38 variables were used in the final model system.

The results from the measurement model show that all latent indicators provide a consistent measure as indicated by high factor loadings (estimated coefficients) and high r-square values (table 2). The results from the structural equation model show that the independent latent construct "general information" affects both "banking services" as well as core banking services (or online banking index, see table 3). Again the coefficient estimates are significantly different from zero and hold the positive sign in all cases. The overall fit of the model, as indicated by a significant chi-square value (χ^2 10.50, d.f. =12, p-value=0.49), is significantly high.

Descriptive statistics pertaining to the financial variables and the online banking index obtained from the structural equation model are reported in table 4 and the parameter estimates from the econometric model are reported in table 5. Some of the main results from the econometric model include the negative impact of consumer loans on return on equity, negative impact of non-interest expenses to revenue ratio (often referred to as an inefficiency ratio in the literature), positive impact of net interest margin on both return on equity as well as asset quality measure (overdue asset ratio). In particular, the positive coefficient associated with net interest margin in both the earnings measure as well as the asset quality measure shows that banks that take more risk earn a higher and may acquire some bad loans as part of the process. These results are consistent with the prior studies.

As expected, our variable of interest, the online banking index is positive in the return on equity equation and negative in the overdue asset ratio equation. In particular, a one unit increase in the online banking index would increase return on equity by 0.16 units. On the other hand, online banking also helps community banks in reducing their poor assets. As banks obtain better information about their customers' financial practices the bank can make better lending decisions. Online banking is expected to provide better information as all transactions are digitized and can be easily analyzed before making lending decisions.

Concluding Remarks

A structural equation model was used to develop an online banking index and the index was included in an econometric model to examine whether the index explains differences in community bank performance. The results show that banks that provide extensive online banking services tend to perform better than those who lag behind. Results show that online banking helps community banks improve their earning ability as measured by return on equity and improve asset quality by reducing the proportion of overdue or under performing assets.

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Table 1. Online Banking Features/Services Used to Construct Latent Indicators and Create Online Banking Index

Latent Constructs	α	Latent Indicators	α	Online Banking Features/Services Used to Create Latent Indicators
General Information	0.879	Privacy /Security Issues	0.732	Privacy, Security, and E-Form enquiry.
		Community Information	0.670	Website search, Newsletter, Community information, and Weather.
		Bank Location and Services	0.865	Branch information, ATM locator, Customer support, and financial services.
Banking Services	0.719	Bill Payment Service	0.743	Express internet banking, Bill pay, and Bill pay demo.
		Financial Mgmt. Service	0.750	Trust, Investment, and Brokerage.
		Business Service	0.800	Sweep accounts, ACH, Merchant services, Tax filing, and Cash management.
Core Banking Services	0.825	Commercial Loans	0.870	Commercial loans, Business line of credit, Business mortgage, and Agricultural real estate.
		Residential Real Estate	0.749	Mortgage, Home equity loans, Home equity line of credit, and Refinancing services.
		Personal Banking	0.966	Checking accounts, Saving accounts, CDs, IRAs, Money market accounts, Customer loans, Check images, Download accounts.

Note: Online banking information of 797 banks was collected by analyzing website features and online services offered by the bank. Initially, 97 web features and services were identified by analyzing a small sample of bank website and these 97 variables were used to analyze other banks included in the sample. The sample includes all community banks with asset size less than 1 billion dollars in Iowa, Minnesota, Montana, North Dakota, and South Dakota. In total 1183 community banks were identified in these 5 states and examined for their web presence. The sample includes financial information about all these banks but only 797 of them had website.

Table 2. Measurement Equations for Online Banking Index

Latent Construct	Indicator	Estimated Coefficient	R^2
General Information			
	Privacy/Security Issues	0.966	0.932
	Community Information	0.814	0.662
	Bank Location/Services	0.893	0.797
Banking Services			
	Electronic Bill Pay	0.919	0.844
	Financial Services Management	0.683	0.466
	Business Services	0.886	0.785
Core Banking Services			
	Commercial Loans	0.877	0.769
	Residential Real Estate Loans	0.880	0.774
	Personal Banking	0.962	0.925

Note: Coefficients reported here are completely standardized parameters estimated using Lisrel software.

Table 3. Structural Equation Parameter for Online Banking Index

Latent Construct	Banking Services	General Information	R^2
Banking Services		0.881	0.881
Online Banking Index (Core Banking Services)	0.298	0.647	0.848

Note: Coefficients reported here are completely standardized parameters estimated using Lisrel software.

Table 4. Descriptive Statistics on Financial Variables Used in Econometric

Variable Description	Sample Average	Standard Deviation
Return on Equity	11.3	9.1
Proportion of Overdue Assets	1.3	1.3
Assets per Employee	3146.5	2147.5
Liability Asset Ratio	0.9	0.1
Equity Asset Ratio	11.1	6.2
Fixed Asset Ratio	2.6	14.2
Asset Growth Rate	10.8	59.8
Employment Growth Rate	5.4	21.9
Non-interest Income over Expenses	27.2	63.0
Net Interest Margin	4.2	1.4
Non-interest Income over Revenue	70.0	64.3
Business Loan to Loan	0.2	0.1
Consumer Loan to Loan	0.1	0.1
Online Banking Index	96.5	5.1

Model Source: FDIC Online database (SDI) downloaded from: http://www2.fdic.gov/sdi/main.asp and author's estimates.

Table 5. Regression Results for Return on Equity and Overdue Asset Ratio

Variable	Return on Equity		Overdue Asset Ratio	
	Coefficient	t-Value	Coefficient	t-Value
Intercept	-13.3200**	-2.81	3.8559**	4.99
Business Loans to Total Loans	-3.1530	-1.28		
Consumer Loans to Total Loans	-7.3193**	-3.10		
Equity to Assets			-0.0112	-1.29
Fixed Assets to Total Assets	-0.0333*	-2.01	-0.0011	-0.44
Non-Interest Income to Total Income	0.0037	0.95	0.0008	1.16
Non-Interest Expenses to Revenue	-0.0285**	-7.39	0.0000	-0.06
Liabilities to Assets	0.8761	0.47	0.5837*	1.95
Assets per Employee	0.0012**	10.31	0.0000	-0.55
Net Interest Margin	1.8956**	9.02	0.1931**	7.59
Average Asset Growth Rate	-0.0019	-0.28	-0.0027**	-2.69
Average Employment Growth Rate	-0.0143	-0.77	0.0098**	3.44
Online Banking Index	0.1584**	3.37	-0.0390**	-5.40

**,* Denote significance at 1 and 5 percent level.