

CONSOLIDATION IN THE US CREDIT UNION SECTOR: DETERMINANTS OF THE HAZARD OF ACQUISITION

by

John Goddard
School of Management, University of Wales

Donal McKillop
School of Management, Queen's University Belfast

John Wilson
School of Management, St. Andrews University

October 2008

Abstract

In recent years, the US credit union sector has undergone a wave of consolidation. This paper through the estimation of hazard functions for credit union disappearances identifies the determinants of acquisition for US credit unions during the period 2001 to 2006. The hazard of acquisition is inversely related to both asset size and profitability, and positively related to liquidity. Growth-constrained credit unions are less attractive acquisition targets. Credit unions with low capitalization and those with relatively small loans portfolios are attractive as acquisition targets. The investigation also presents unique empirical evidence of a link between technological capability and the hazard of acquisition. During the period 2001 to 2006 when there was sustained growth in the uptake of internet technology, credit unions with no website were at the highest risk of acquisition, followed by those with informational, interactive and transactional websites. In other words, the risk of acquisition decreases as the level of website sophistication and capability increased.

Keywords: Credit unions, consolidation, acquisition, technology

JEL: G21

Acknowledgements

The authors would like to thank Bob Adams, Allen Berger, Bob DeYoung, Doug Evanoff, Phil Molyneux, Neil Murphy, Evren Ors, Linda Powell, Frank Schmid and Larry Wall for useful comments, insights and suggestions. We would also like to thank an anonymous referee for a number of comments which helped us strengthen the paper. We would also like to thank the participants at the Mergers & Acquisitions of Financial Institutions Conference at the FDIC, Arlington in November 2007 and the Workshop on Cooperative Banking at the Helsinki School of Economics in December 2007. The usual disclaimer applies. John Goddard would like to thank Ente Luigi Einaudi for Monetary, Banking and Financial Studies, Rome, for hospitality and financial support during a visiting appointment as a Targeted Research Fellow in Autumn 2007.

CONSOLIDATION IN THE US CREDIT UNION SECTOR: DETERMINANTS OF THE HAZARD OF ACQUISITION

1. INTRODUCTION

In recent years, technological change and deregulation have fundamentally transformed the financial services industry. Technology improvements in data collection, storage and processing capabilities have occurred, and costs of product development and service delivery have declined. Financial institutions are now able to trade more freely in their local markets, and often beyond. Consequently, they have also increased the range of products and services to customers. Increased competition from a myriad of financial institutions has led to an increased emphasis on efficiency and profitability.

Many financial institutions have responded to the changing competitive environment by expanding, either through internally generated growth, or through merger and acquisition. Growth has enabled banks to realize scale and scope economies, reduce labor and other variable costs, and reduce or eliminate operational inefficiencies. Many financial institutions have sought to diversify their revenue sources. As net interest margins have been subjected to increasing competitive pressure, resulting, generally, in a depression of earnings streams relative to costs, many financial institutions have focused on achieving growth from other, non-interest income sources. Consolidation via acquisition and merger has contributed significantly to a reduction in the number of financial institutions in many countries (Nolle, 1995; Berger et al., 1995; Berger et al., 1999; Amel et al., 2004; Jones and Critchfield, 2005; Goddard et al., 2007). “(T)he extraordinary advance in communications and data processing technology over the last two decades is the single most powerful underlying force... driving the merger wave” (Broadus, 1998, p5).

In many countries, the credit union sector (in common with the banking and insurance sectors) has also experienced a wave of consolidation. However, with relatively few exceptions (Fried et al., 1999; Ralston et al., 2001; Worthington, 2004), this increase in merger activity has remained unexplained. In this study, we seek to fill this gap by examining the determinants of merger activity

for the US credit union sector. Most previous studies of merger activity in financial services have neglected the role of technology. An important contribution of this paper is the incorporation of technology variables into a model of the determinants of the probability of acquisition or failure for financial institutions.

The rest of this paper is structured as follows. Section 2 outlines the structure of the US credit union sector. Section 3 reviews the theoretical and empirical literature on merger, and technology adoption, with particular emphasis on the financial services industry. Section 4 describes the data set, and develops an empirical model for the determinants of credit union acquisition. Section 5 presents the results of the empirical analysis. Finally, Section 6 summarizes and concludes.

2. THE US CREDIT UNION SECTOR

Credit unions are not-for-profit financial cooperatives. Each credit union is governed by its members, who elect from within the membership unpaid volunteer officers and directors. Voting is on a one-member-one-vote basis, regardless of the size of each member's financial stake. At the end of 2006 there were 8,372 credit unions in the US, with a membership of 87 million and total assets of \$710 billion (National Credit Union Association, NCUA, 2006a). In recent years the asset and membership base of US credit unions has grown, but the number of credit unions has declined through consolidation. As credit unions have become larger and more sophisticated, there has been a gradual shift away from using volunteers for day-to-day operational needs and towards salaried employees. For example, Black and Dugger (1981, p, 538) argue that "increased complexity has reduced the proportion of volunteer labour which has tended to reduce credit union earnings". Credit unions serve a membership defined theoretically by a common bond (Goddard et al, 2002). The common bond might restrict membership to members of a local community, employees of a particular firm, or individuals with some other organizational affiliation (such as a church).¹

¹ An associational common bond comprises of members and employees of a recognized association. This includes individuals or groups whose members participate in activities developing common loyalties, mutual benefits, and mutual interests. Community credit unions comprise persons who live, work, worship, or attend school in the same well-defined local community, neighborhood, or rural district. An occupational common bond credit union has a field of membership which consists of employees of the same entity or related entities or part of a trade, industry, or profession.

Growth in membership has also been accompanied by product diversification, particularly in the case of the larger credit unions (Goddard et al., 2008a). Many credit unions provide an array of retail financial services similar to those of banks and savings and loan associations. In addition, credit unions may also offer interest-bearing business checking accounts and commercial loans, agricultural loans and venture capital loans. Credit unions may also deal in investment products such as bankers' acceptances, cash forward agreements and reverse purchase transactions. These product offerings have further blurred the lines of demarcation between credit unions and mainstream financial services providers (Tokle and Tokle, 2000; Feinberg, 2001; Feinberg and Rahman, 2001; Hannan, 2003; Schmid, 2005).

Recently technological change has impacted heavily on the structure, operations and economics of both credit unions and the wider financial services industry. Information technology (IT) alters the ways in which customers can access services, mainly through automated distribution channels such as the internet, phone-based and other banking access channels. IT can also yield cost savings associated with the management of information (collection, storage, processing and transmission), and by substituting paper-based and labour-intensive procedures with automated processes² (Hernando and Nieto, 2007; DeYoung et al., 2007).

3. MERGER AND TECHNOLOGICAL ADOPTION

In this section, we provide a selective review of academic literature on the motives for merger and acquisition, and the adoption and diffusion of new technology. In each case, we focus primarily on literature that is relevant to financial services, and provide some key citations from the broader accounting, finance and industrial organization literature.

² Technological change in financial services can be classified under four main headings: Customer Facing Technologies; Business Management Technologies; Core Processing Technologies; and Support and Integration Technologies. Customer Facing Technologies include Automated Teller Machines (ATM), Electronic Funds Transfer at the Point of Sale (EFTPOS), Telephone Banking, Call Centres, Internet Banking, E-Commerce and E-Card Business and Customer Relationship Management Systems (CRM). Business Management Technologies include Data Warehousing, Data Mining, Middleware, Credit and Risk systems. Core Processing Technologies include Cheque Processing, Statement Issuance, Interest and Charging Systems. Support and Integration Technologies include Human Resources Systems, Finance Systems and Technology Support Systems.

3.1 Merger

Corporate finance theory summarises the motives for merger activity in any industry under the general headings of synergy, hubris and agency conflict (Collins, 2003; Copeland et al., 2005). Synergy, the most common justification given by senior management for merger proposals, refers to the increased market power of the merged entity, and to the potential for cost savings. Cost savings may be realized through the exploitation of scale economies, vertical integration, or the adoption of more efficient production or organizational technology. Savings may be realized through the elimination of overlapping costs, by combining head office and various back office functions or branch networks. Scope economies, realized through the cross-selling of products and services, as in deals involving banks and insurance companies, may also be available. Mergers may allow the exploitation of certain accounting advantages, such as under-utilized tax shields. Another possible cost saving derives from the removal of inefficient management at the target institution.

The hubris hypothesis suggests that managers make mistakes in evaluating target firms, and overestimate the potential for synergy (Roll, 1986). Consequently, bidding firms tend to pay too much for the target. Finally, according to the agency conflict hypothesis, acquiring managers deliberately overpay for their targets, because they benefit personally, even if the stock price and shareholder wealth is adversely affected. There may be greater prestige associated with managing a larger organization; promotion opportunities may be better; or merger may divert attention and allow senior managers to avoid dismissal if their institution has been performing poorly.³

Empirical evidence on the motives for bank merger tends to confirm the importance of the synergy motive (Zhang, 1995; Grabowski et al., 1995; Rhoades, 1998; Wheelock and Wilson, 2000, 2004; Focarelli et al., 2002).⁴ Banks with low earnings, low capital-to-assets ratios, high local market

³ Gorton et al. (2006) develop a hybrid theory that combines managerial motives and a regime shift. They argue that managers benefit personally from operating the firm, and therefore have an incentive to keep the firm independent. However, if a regime shift increases the importance of economies of scale, managers come under pressure to increase firm size, either for defensive or for strategic positioning reasons. "Our models show that in industries with economies of scale, firm size becomes the driving force for merger dynamics. Often this leads to profitable acquisitions. However, if a firm becomes very large and its manager's private benefits are high, it may engage in unprofitable defensive acquisition." (Gorton et al., 2006, p4).

⁴ Some non-bank studies also report evidence in support of the hubris and agency hypotheses (Berkovitch and Narayanan, 1998; Rossi and Volpin, 2004). Cross-country merger studies suggest that differences in accounting

share, or which operate in urban areas, are more likely to be acquired (Hannan and Rhoades, 1987; Amel and Rhoades, 1989; Moore, 1997; Hadlock et al., 1999; Hannan and Piloff, 2006).

Studies of the impact of bank mergers examine either pre- and post-merger cost efficiency using accounts data, or stock price reactions to merger announcements. Using accounts data, Rhoades (1986) finds no difference between the performance of US banks that were acquired and those that were not, but using bank merger case studies, Rhoades (1998) finds some evidence of cost savings. Spindt and Tarhan (1992) find that the profitability of many US merged banks improved in the years after merger. However, the view that realized post-merger cost efficiency gains are limited in US and European banking is prevalent (Berger and Humphrey, 1992; Peristiani, 1997; DeYoung, 1997; Houston et al., 2001; Carbo et al., 2003). Recent empirical evidence suggests that information spillovers from previous mergers, and learning-by-doing within banks, have led to efficiency gains and improved post-merger returns (DeLong and DeYoung, 2007; Al-Sharkas et al., 2008).

Some studies that focus on profit efficiency report post-merger benefits (Akhavain et al., 1997; Berger, 1998). Cornett et al. (2006) report that geographically focused mergers provide both revenue enhancements and cost savings. Park and Pennacchi (2007) report that mergers involving large multimarket banks in the US tend to enhance competition in loan markets, but damage competition in deposit markets. Ashton and Pham (2007) find that UK bank mergers had a negligible effect on deposit rates, and a slight positive impact on efficiency. Finally, Altunbas and Ibáñez (2007) find that focused deals involving European banks with similar strategies results in increased efficiency and profitability.

Among studies of the impact of bank mergers on shareholder value, Beitel et al. (2004) and Campa and Hernando (2006) find that European mergers produce positive cumulative returns to target shareholders, but have little effect on cumulative returns to bidder shareholders. In contrast, Knapp et al. (2005) find evidence of negative returns to shareholders of merged US banks.

Overall, the empirical evidence on bank mergers suggests there is often little improvement in the efficiency or performance of the merged entity. This suggests that the hubris and agency conflict

standard and shareholder protection are significant drivers of shareholder activities (Rossi and Volpin, 2004; Buch and DeLong, 2004; and Pozzolo and Focarelli, 2007).

motives for merger may be relevant; or that improvements in performance derive more from enhanced market power than from cost savings. These explanations are not mutually exclusive: increased market power might be reflected in senior managers directing a larger proportion of revenues towards executive salaries or fringe benefits; or large banks might choose to adopt risk-averse strategies (Berger and Hannan, 1998). This could explain why increased market power resulting from merger is not always reflected in increased profitability or shareholder value.

Evidence on the motives for credit union mergers is limited, but three studies are noteworthy⁵. Fried et al. (1999) finds that in the US, acquiring credit unions benefit more when they and the target credit union have different levels of profitability, different numbers of select employee groups, and when one of them has a community charter. This implies that the acquired credit union can exploit the complementarities offered by the merger. On average, members of acquiring credit unions experienced no deterioration in service provision post-merger, while members of acquired credit unions experienced improvements of at least three years' duration.

For Australian credit union mergers, Ralston et al. (2001) find mixed evidence of post-merger gains and losses in technical and scale efficiency. The highest gains were found where pre-merger efficiency scores were low for both partners. This is inconsistent with the notion that efficiency gains are realized by transferring assets from inefficient managers to efficient managers. Finally, in a study of the determinants of merger for Australian credit unions, Worthington (2004) finds that asset size and quality, managerial efficiency; earnings and liquidity are all significant drivers of merger activity.

3.2 Technology adoption and diffusion

Technological change might provide the impetus for industry consolidation. Mergers take place when managers respond to technological or regulatory shocks, which change the industry's cost and demand conditions (Gort, 1969; Mitchell and Mulherin, 1996). In the case of major technology shocks such as the IT revolution of the late-20th century, a merger wave can spread across many industries simultaneously. At the same time, merger activity might serve as an important vehicle for

⁵ McKillop et al. (2006) explore the issue of mergers for Irish credit unions while Goth et al. (2005) provide a commentary on the motives for mergers in UK credit unions.

the diffusion of new technology (Mansfield, 1961, 1969; Damanpour, 1991, 1992). Mergers play a role in the diffusion process by speeding up the transmission of new information, and spreading the risks associated with new technologies over larger volumes of output.⁶

Technological change has impacted dramatically on the structure, operations and economics of financial services. Developments in information collection, storage, processing, transmission and distribution technologies impact on financial services in three ways. First, they contribute to cost savings associated with the management of information (collection, storage, processing and transmission), mainly by substituting paper-based and labour-intensive procedures with automated processes. Second, they alter the ways in which customers access services and products, mainly through automated distribution channels (by phone or via the internet). Third, engagement with new technologies has in many cases increased profitability through increased revenues from service charges or lower processing costs (Hernandez and Nieto, 2007; DeYoung et al., 2007).

In banking, several studies have examined patterns of adoption of innovations, including: Auto Teller Machines (Hannan and McDowell, 1984; 1986; Saloner and Shepard, 1995); Automated Clearinghouse Settlement Systems (Gowrisankaran and Stavins, 2004); credit scoring technologies (Akhavain et al., 2005); Real Time Gross Settlement Systems (Bech and Hobijn, 2006); and debit cards and electronic giro transactions (Bolt et al., 2008).

Furst et al. (2002) use multivariate logit regressions to identify factors driving the adoption of internet banking. Banks that incurred high fixed costs relative to net operating revenues, were members of a bank holding company, or were located in an urban area, were more likely adopters. Courchane et al. (2002) examine the decision to invest in internet banking using a two-stage real options framework. Bank size, industry concentration and bank location were significant determinants

⁶ Smythe (2001) examines mergers in US manufacturing industries between 1895-1904 using a Schumpeterian framework. The turn-of-the-century merger movement was “... the consequence of an aggressive, unremitting technological competition that concurrently swept across a wide swathe of American industries in the wake of the technological innovations clustered at the end of the nineteenth century. Because the implementation of these innovations required significant capital investments, and because the outcome of the competitive process was highly uncertain, firms’ incentives to cooperate with their rivals were increased at the same time that sustaining such cooperation at arms length was made impossible. The only way of realizing the benefits of cooperation, therefore, was by internalizing it through horizontal mergers. Once realized, the cooperation helped facilitate the capital investments necessary to implement the new technologies” (Smythe, 2001, p254).

of the probability of adoption. Nickerson and Sullivan (2003) suggest banks are more likely to adopt internet banking where uncertainty over the level of demand is low. Sullivan and Wang (2005) find that the adoption of internet banking was slower in US states where average income is low, where there is a scarcity of internet access, where financial institutions are older, and where average bank size is smaller. Fuentes et al. (2006) find that banks are more likely to adopt transactional internet banking when competition is intense, and when rival banks have already adopted. Akerberg and Gowrisankavan (2006) examine the role of network effects in the decision to adopt Automated Clearing House (ACH) technology. On the supply side, a bank is more likely to adopt ACH as other banks adopt. The importance of the network effect depends on the incremental profits to the bank from each ACH transaction relative to the fixed cost of adoption. There are also network effects on the demand side. ACH customers also incur a fixed cost of adoption, and are more likely to adopt if businesses with which they transact also adopt. While bank fixed costs of ACH adoption are low, customer fixed costs of adoption are high, and the latter acts as an impediment to ACH adoption.

Many US credit unions now offer financial services via electronic distribution channels, including internet banking, home banking (direct dial in) services, wireless services, phone and audio based banking services, and kiosk and online e-commerce transaction processing services. Credit union members can carry out the following activities electronically: account enquiries; check order requests; make loan applications; pay bills; transfer funds; stop payment requests; online wire transfers; ACH originations and transactions; account aggregation queries, and ATM service facilities.

A recent US credit union survey by Callahan and Associates (2007) suggests that technology plays a key role in credit unions' attempts to retain and increase membership, enhance competitiveness, improve efficiency and improve member services. The ratio of IT expenditure to total operating expenditure exceeded 10% for more than 40% of the credit unions sampled.⁷ However,

⁷ In attempting to devise a typology of technology-based investment, Callahan and Associates (2007) distinguish between critical applications; steady state technologies; monitoring technologies; and up-and-coming technologies. Critical applications are technologies with a high adoption rate and high planned investment, including bill pay services, internet home banking, e-statements, and automated fraud tools. Steady state technologies are those with high adoption but low planned investment, including website calculators, outsourced firewall management, and voice over internet protocol. Monitoring technologies are those with low adoption and low planned investment, including CRM software, video conferencing, and online mortgage approval. Up-

online members represent a challenging demographic for credit unions, because they tend to use multiple financial service providers, and are willing to use online tools to switch their funds between providers.

In the academic literature on technology adoption in the US credit union sector, Ono and Stango (2005) examine the factors that influence the decision to outsource information technology services. The decision to outsource is associated with asset size, and the diversity of the credit union's product offerings. Using a game-theoretic model, Borzekowski and Cohen (2005) find that the propensity to outsource is increasing in the number of other credit unions in the same geographic location that also elect to outsource. Dow (2007) examines the adoption of web and computer based banking for US credit unions over the period 2000-2003, and finds that larger credit unions were more likely to adopt new technologies early than their smaller counterparts.

Overall, the empirical literature on technology has focused on the adoption or outsourcing of process technologies, their diffusion and impact on performance. Size, industry structure and geography all appear to play an important role in the adoption and diffusion of technologies. This study examines the role that technology adoption plays in the consolidation process.

4. DATA AND MODEL SPECIFICATION

4.1 Data and sample selection

In this section, we describe the data that are used below to estimate a hazard function for the disappearance through acquisition of US credit unions, and we discuss the selection of hazard function covariates. The credit union balance sheet and income statement data are compiled from the '5300 Call Reports' published by the NCUA. Semi-annual data are available for the period June 2001 to June 2006, providing a maximum of 11 time-series observations on each credit union. Disappearance through acquisition refers to the case where the acquiring credit union absorbs all of the assets and liabilities of the acquired credit union.⁸

and-coming technologies are those with low adoption and high planned investment, including business back-up systems; and new member account funding via the internet.

The covariates of the hazard functions control for asset size, market penetration, age, profitability, liquidity, risk, asset mix, asset quality, managerial efficiency and technological capability. In addition, we include controls for the charter and common bond characteristics of each credit union, distinguishing between state and federally chartered credit unions, and between single and multiple common bond credit unions.

The complete list of covariate definitions is as follows:

Size:	LASSET = natural logarithm of total assets
Market penetration:	MEMPOT = actual members / potential members
Age:	LAGE = natural logarithm of (current year – year of formation)
Profitability:	ROA (return on assets) = net income / total assets
Liquidity:	LIQ = (cash on hand + cash on deposit + cash equivalents) / total assets
Capital adequacy:	CAPASS (capital-to-assets ratio) = net worth / total assets
Asset mix:	LOANASS = total loans / total assets
Asset quality:	NONPER = non-performing loans / total loans
Efficiency:	NINTASS = non-interest expenses / total assets
Technological capability:	
	TECH1 = 0-1 dummy identifying credit unions with an informational website
	TECH2 = 0-1 dummy identifying credit unions with an interactive website
	TECH3 = 0-1 dummy identifying credit unions with a transactional website
Charter type:	FED = 0-1 dummy identifying federally chartered credit unions
Common bond:	MULT = 0-1 dummy identifying multiple common bond credit unions

For June 2001, NCUA report data for 10,269 credit unions. We eliminated from the sample credit unions falling into each of the following categories:

⁸ Merger and acquisition proposals require prior approval from the NCUA, dependent upon compliance with state and federal legislation, and an assessment of whether the proposal is in the interests of the members of the credit unions concerned. The proposal must also be presented at a membership meeting, and there are various thresholds for the proportions of members voting in favour. The NCUA delegates responsibility for managing liquidation or P&A to the Asset Management and Assistance Centre (AMAC), which manages the repayment of insured deposits (shares), sale of loans, liquidation of assets and cancellation of charters.

- (i) Privately insured credit unions, for which coverage in the NCUA database is incomplete for the period 2001-06.
- (ii) Credit unions that converted to banks during the period 2001-06.⁹
- (iii) Credit unions reported as either liquidated or subject to a Purchase and Assumption order during the period 2001-06.
- (iv) Credit unions that reported an extreme or unbelievable value for any variable.
- (v) Credit unions for which the year of formation was not reported.
- (vi) Other credit unions for which there were missing data

Trimming the sample resulted in the loss of 758 credit unions (7.4% of the total reported for June 2001). The final sample comprises 9,511 credit unions that were live in June 2001, of which 7,941 were live in December 2006 and 1,570 were acquired between June 2001 and December 2006.

4.2 Choice of hazard function covariates

In the rest of Section 4, we discuss the theoretical basis for the selection of covariates for the hazard functions for credit union disappearances, and we comment on the sample summary statistics for each of the covariates. The summary statistics are reported in Tables 1 to 4. Table 1 reports sample means, standard deviations and correlation coefficients for the time-varying covariates of the hazard function model, excluding the technology covariates. In calculating these summary statistics, the semi-annual observations on each sample credit union from the period June 2001 to June 2006 (inclusive) are pooled. Accordingly, each sample credit union contributes up to 11 observations to the summary statistics. Table 2 reports summary statistics for the non-time-varying covariates. These statistics are reported separately for all sample credit unions, and for the credit unions that were acquired. Table 3 reports sample mean values for the time-varying covariates in each semi-annual period, calculated using the data for all surviving (non-acquired) credit unions in each period. Table 4

⁹ The 1998 Credit Union Membership Access Act lowered the regulatory hurdles for the conversion of credit unions into banks. The benefits associated with conversion include increased access to capital, and the relaxation of restrictions on investment and lending activities. However, credit unions that convert lose their tax-exempt status, and must comply with the 1977 Community Reinvestment Act (Wilcox, 2006, 2007). Around 30 conversions took place between 2001 and 2006.

reports the sample mean values for the time-varying covariates for credit unions that were acquired, calculated using only the data from the last-reported observation on each acquired credit union.

The relationship between asset size and performance is widely documented in the theoretical and empirical banking literature (Boyd and Runkle, 1993; Demsetz and Strahan, 1997; Berger and Mester, 1997; Goddard et al., 2004). Economies of scale in screening, lending and monitoring may render large financial institutions better able to judge cost and demand conditions. Kohers and Mullis (1987) note that small US credit unions operate with lower average savings per member; have higher loans-to-savings ratios; maintain a higher degree of liquidity; and have higher provisions for loan losses than their larger counterparts. The assets of a small credit union might be used more efficiently if the credit union was acquired and its assets absorbed into a larger institution. Therefore we expect a negative coefficient on LASSET in the hazard function for acquisition. Table 3 indicates that the average asset size of the sample credit unions increased steadily throughout the sample period, while Table 4 indicates that the credit unions that were acquired were much smaller on average than those that survived.

Age might be correlated with a number of unobservable managerial characteristics that could impact on the probability of acquisition, but we have no specific prior concerning the sign of the coefficient on LAGE. Older organisations might benefit from learning economies, making them more adept at judging changes in cost and demand conditions. Alternatively, there might be a tendency for older credit unions to become ossified, less agile and less responsive to changing market conditions (Barron et al., 1994). There is some recent empirical evidence to support the proposition that younger credit unions tend to grow faster (Goddard et al, 2002; Goddard and Wilson, 2005). However, Table 2 suggests there was little difference between the age profile of the sample as a whole, and that of the credit unions that were acquired.

The market penetration measure shows the number of actual members of the credit union as a proportion of the potential membership determined by the terms of the credit union's charter. High market penetration indicates that a credit union has already captured most of its potential membership, and further growth under the credit union's present common bond designation may be constrained. In this case, absorption into another credit union with a broader common bond designation through

acquisition might eliminate this growth constraint, and we would expect a positive coefficient on MEMPOT in the hazard function. Alternatively, a growth-constrained credit union might represent an unattractive target to a potential acquirer, in which case a negative coefficient might be expected. At the start of the sample period, credit unions that were about to be acquired had slightly higher average values of MEMPOT than the sample as a whole (Tables 3 and 4). This difference appears to have narrowed over the course of the sample period.

It seems likely that credit unions with poor profitability are more likely to be acquired than those with high profitability. Therefore we expect a negative coefficient on ROA in the hazard function. In fact, the average ROA of acquired credit unions immediately before they disappeared was always negative, and considerably lower than the average ROA of the sample as a whole. A highly liquid credit union might be at greater risk of being acquired than an illiquid one, because high liquidity makes it an attractive target for a less liquid acquirer, or because it may be forgoing an investment return on the assets concerned. Therefore we expect a positive coefficient on LIQ. According to Tables 3 and 4, the average LIQ of credit unions that were about to be acquired was higher than the average for the sample as a whole.

In common with other financial institutions, credit unions are subject to capital requirements.¹⁰ Goddard et al. (2008b) find that most credit unions hold significantly more capital than is required under the regulatory framework, and on average, small credit unions operate with higher capital-assets ratios than large ones. We might expect either a positive or a negative relationship between CAPASS and the probability of acquisition. A positive relationship might be expected if a credit union holds excess capital because it has limited opportunities for growth. This would make a highly capitalized credit union an attractive target to a growth-oriented acquirer. Alternatively, an acquirer might be poorly capitalized, and seeking to improve its capitalization by

¹⁰ Credit unions cannot raise capital as easily as other financial institutions, because they cannot issue equity. However, the tax-exempt status of any capital the credit union raises internally through retained earnings may be interpreted as a form of subsidy to shareholders. This has been justified as beneficial for tackling financial exclusion, on the grounds that credit unions serve low-income clients; but a 2001 Federal Reserve survey of consumer finance suggested that credit unions do not actually serve a higher proportion of such clients than other financial institutions. Recently, US Congress has asked the NCUA to collect data to identify the types of services provided to members, the income distribution of members, and levels of executive compensation and benefits to board members (US Government Accountability Office, 2005; NCUA, 2006b).

acquiring a well-capitalized target. Tables 3 and 4 indicate that for 10 of the 11 semi-annual periods, the average value of CAPASS was slightly higher for the credit unions that were about to be acquired than for the sample as a whole.

Conversely, a negative relationship between CAPASS and the hazard of acquisition might be expected if the acquired credit union's high capitalization is a proxy for efficiency, suggesting limited scope for further efficiency gains following a merger. According to Hannan and Piloff (2006), acquirers might prefer a high level of leverage because this enables them to maximize post-merger performance gains relative to the cost of achieving those gains.

Credit unions with relatively small loans portfolios might be vulnerable as targets for acquirers who may believe they can earn a higher return by increasing the size of the loans portfolio. Therefore we expect a positive coefficient on LOANASS in the hazard function. Tables 3 and 4 indicate that average values of LOANASS are generally lower for the credit unions that were about to be acquired than for the sample as a whole.

A high ratio of non-performing loans to total loans should be a relevant indicator of potential financial difficulties or insolvency; and if financial difficulties are a trigger for acquisition we should expect a positive coefficient on NONPER in the hazard function. The average values of NONPER are higher for the credit unions that were about to be acquired than for the sample as a whole. Completing the list of company accounts covariates, the ratio of non-interest expenses to total assets is employed as a crude measure of cost efficiency. On the grounds that inefficient credit unions are likely to be more vulnerable to acquisition, we would expect a positive coefficient on NINTASS. However, the average values of NINTASS are generally lower for the credit unions that were about to be acquired than for the sample as a whole (although the difference does not appear large relative to the random variation in NINTASS for the acquired credit unions).

The increasing penetration in recent years of internet technology into all aspects of commercial activity provides opportunities for studying the interactions between technology adoption and diffusion, and other strategic decisions of commercial organizations, including merger and acquisition in the present case. Our prior is that a credit union that is backward in the adoption of internet technology might be at greater risk of acquisition by an institution whose managers have the

requisite technological capability, and might be able to earn a higher return on assets than the backward credit union's current managers.

We identify three indicators of internet technology adoption, dependent on the existence and capabilities of the credit union's website. At the first (lowest) level, an informational website displays general information on interest rates, and contract details. At the second (intermediate) level, an interactive website also allows members to request information on share and loan balances, and to request statements. It also accepts applications for membership, loans or share accounts. Finally, at the third (highest) level, a transactional website also allows members to complete transactions such as paying bills, make loan payments or deposits, and transfer funds between accounts. In accordance with the preceding discussion, we expect negative coefficients on the dummy variables TECH1, TECH2 and TECH3 in the hazard function. Tables 3 and 4 indicate that the credit unions that were about to be acquired were much more likely to have developed websites immediately prior to acquisition than the sample as a whole.

Finally, only those individuals who fall within a credit union's common bond (field of membership) can use the credit union's services. Both state governments and the federal government charter credit unions.¹¹ In the hazard functions, the dummy variable MULT distinguishes between single and multiple common bond credit unions, and the dummy variable FED does the same for state chartered and federally chartered credit unions. The summary statistics suggest that a relatively high proportion of the acquired credit unions were single common bond, but the proportions of acquisitions that were state chartered and federally chartered were similar to those for the sample as a whole.

5. ESTIMATION METHOD AND RESULTS

5.1 Estimation method

The estimation of hazard functions for the disappearance of US credit unions through acquisition is based on the method used by Wheelock and Wilson (2000) to model the determinants of

¹¹ The laws governing state-chartered credit unions' common bond limits and powers tend to be more liberal than the corresponding federal laws. State chartered credit unions may therefore assume more risk or adopt more aggressive portfolio management techniques. However, state chartered credit unions are unable to branch across state lines, and are therefore subject to a significant constraint on their growth.

failure and acquisition for US banks. The empirical model for the hazard is based on the Cox (1972) proportional hazard model with time-varying covariates.

The hazard function expressing the probability that credit union i is acquired between time t and time $t+1$, conditional on a vector of covariates specific to credit union i at time t that influence the probability of acquisition, denoted $x_i(t)$, is modelled as follows:

$$\lambda_i(t | x_i(t), \beta) = \bar{\lambda}(t) \exp(x_i(t)' \beta)$$

$\bar{\lambda}(t)$ denotes the baseline hazard, and β is a vector of coefficients to be estimated. The time-index t is measured in calendar time elapsed since the first observation, for June 2001. Since all sample credit unions were in existence in June 2001, calendar time and duration until acquisition are equivalent for all observations in the data set. Observations on the credit unions that were not acquired between June 2001 and December 2006 are treated as right-censored.

We let R_t denote the set of credit unions that are in existence at time t and at risk of acquisition between t and $t+1$, and we let D_t denote the set of d_t credit unions that are acquired between time t and time $t+1$. The contribution to the partial likelihood function of credit union i , which is acquired between t and $t+1$, is:

$$\exp(x_i(t)' \beta) / \sum_{j \in R_t} \exp(x_j(t)' \beta)$$

We note that $\bar{\lambda}(t)$ drops out when the partial likelihood function is formed. Therefore $\bar{\lambda}(t)$ is not parameterized explicitly, and the proportional hazards model is described as semi-parametric. The log-partial likelihood function is:

$$\ln[L(\beta)] = \sum_{t=1}^T \left[\sum_{i \in D_t} x_i(t)' \beta - d_t \ln \left\{ \sum_{j \in R_t} \exp(x_j(t)' \beta) \right\} \right]$$

5.2 Hazard function estimation results

NEXT PARAGRAPH NEEDS REWORKED

Table 5 reports the hazard function estimation results. In Equation I, the hazard is for disappearance due to either merger, liquidation or purchase and assumption (P&A). Equations II and III comprise a competing risks model, in which separate hazards are estimated for

disappearance due to merger (Equation II) and liquidation or P&A (Equation III). Equations IV to VI comprise an alternative competing risks model, in which disappearances due to either merger, liquidation or P&A are subdivided according to the reported reason for disappearance. As noted in Section 4, the reported reasons for disappearance are: financial or managerial difficulties; expansion; and reorganization or restructuring. Equations VII to VIII repeat the estimation in Equation I, using only the data for state and federally chartered credit unions, respectively. Finally, Equations IX and X repeat the estimation in Equation I, using only the data for single and multiple common bond credit unions, respectively.

The anticipated inverse relationship between asset size and the hazard of acquisition is evident in all of the hazard function estimations reported in Table 5. The coefficients on LASSET are negative and strongly significant coefficients in all five equations. Therefore subdivision of the sample by charter or by common bond does not affect this strong underlying relationship between size and the hazard of acquisition.

The coefficient on MEMPOT is negative and significant in the estimation for all credit unions, indicating that the closer is the credit union's membership to its maximum, the less likely is the credit union to be acquired. This does not support the hypothesis that acquisition is used as a means for eliminating a constraint on growth, but it is consistent with the hypothesis that acquiring credit unions prefer targets with higher growth potential. The coefficients on MEMPOT in the other estimations are all negatively signed, but not all of these coefficients are significant.

The significant coefficient on LAGE in in the estimation for all credit unions suggests that older credit unions are at greater risk of disappearance. This pattern is repeated in most of the other estimations, but not all of the coefficients are significant.

The anticipated inverse relationship between profitability and the hazard of disappearance is evident in all of the estimations. In general, and as is also the case with the size covariate, subdivision of the sample does not affect the underlying relationship between profitability and the hazard of disappearance. Similarly, a positive relationship between liquidity and the hazard of disappearance is evident throughout Table 5. These results are consistent with the hypothesis that highly liquid credit

unions tend to make attractive targets, perhaps because of a tendency not to realize an adequate return on their assets. We note that Table 1 reports a negative correlation between ROA and LIQ.

The estimation results lend support to the explanations for a negative relationship between CAPASS and the hazard of acquisition advanced by Hannan and Piloff (2006). High capitalization may be a proxy for efficiency, indicating that there is limited scope for post-merger efficiency gains. Alternatively, low capitalization may increase the attractiveness of the target.

In the estimation for all credit unions, the coefficient on NONPER is insignificant. This seems surprising, because Tables 3 and 4 suggest the proportion of non-performing loans was consistently higher for the disappearing credit unions than for the sample as a whole. The explanation may lie in Table 1, which reports relatively high correlation coefficients between NONPER and several other covariates (ROA, LIQ, CAPASS and LOANASS in particular). After controlling for the effects of these other factors on the hazard of disappearance, any apparent effect from NONPER drops out in most cases. In the estimation for state chartered credit unions, however, the coefficient on NONPER is positive and significant at the 1% level, and in the estimation for federally chartered credit unions the coefficient on NONPER is negative and significant at the 10% level. **HAS ANYONE**

AN EXPLANATION FOR THIS?

The coefficient on LOANASS in the estimation for all credit unions is negative and significant. This result is consistent with the hypothesis that credit unions with relatively small loans portfolios are vulnerable as targets to acquirers who may anticipate earning a higher return on assets. The coefficients on LOANASS in the other estimations are all negatively signed, but not all of these coefficients are significant.

The positive coefficient on NINTASS in the estimation for all credit unions is consistent with the interpretation of the ratio of non-interest expenses to assets as a managerial inefficiency measure, and the hypothesis that inefficient credit unions are more vulnerable to acquisition. Although no such pattern is apparent in the sample averages reported in Tables 3 and 4, the pattern becomes apparent in the multivariate model after controlling for other covariates. However, any such effect does not appear to be particularly robust across the other estimations reported in Table 5.

The coefficients on the internet banking covariates TECH1-TECH3 in the estimation for all credit unions are negative and significant. The absolute values of these coefficients are consistent with the hypothesis advanced in Section 4: credit unions with no website are at the highest risk of disappearance, followed by those with informational, interactive and transactional websites respectively, in the anticipated order. In all of the other equations, the coefficients on TECH3 are significant, as are some of the coefficients on TECH1 and TECH2. The results appear to lend support to the hypothesis that the absence of an internet banking capability renders a credit union more vulnerable to acquisition, presumably by acquiring managers who have the requisite technological capability and perceive that they can earn a higher return from the target credit union's assets.

Finally, the coefficient on FED in the estimation for all credit unions suggests that after allowing for the other controls, the hazard of acquisition was higher for state chartered than for federally chartered credit unions. However, the coefficient on MULT suggests there is little difference in the hazard between single and multiple common bond credit unions. Therefore the higher proportion of acquisitions among single common bond credit unions shown in Table 2 seems to be explained mainly by the other covariates, and no effect specific to single common bond credit unions is identified in the multivariate model. In general, the individual estimations for state and federally chartered credit unions, and for single and multiple common bond credit unions, are similar to those for all credit unions, and the determinants of the hazard of acquisition do not appear to vary greatly by charter type or by common bond type.

6. CONCLUSION

In recent years, the US credit union sector has undergone a wave of consolidation. With a few exceptions, however, this increase in merger activity has remained largely unexplained in the academic literature. In this study we have sought to fill this gap, by examining the determinants of disappearance through acquisition for US credit unions. Most previous studies of merger activity in financial services have largely neglected the role of technology. An important contribution of this paper has been the incorporation of technology variables into a model of the determinants of the probability of acquisition for financial institutions.

In common with several other financial services sector merger studies, we have found evidence of a strong inverse relationship between asset size and the hazard of credit union acquisition. Credit unions that are growth-constrained are less likely to be attractive acquisition targets. Older credit unions are at slightly greater risk of acquisition, although the empirical link between age and the hazard of acquisition is not particularly strong or robust.

There is a strong inverse relationship between profitability and the hazard of acquisition. The average ROA of credit unions that disappeared for the six-monthly period immediately preceding disappearance was always negative. Highly liquid credit unions appear to be attractive acquisition targets, perhaps because of the accessibility of their assets in liquid form, or perhaps because they have a tendency not to realize an adequate return on their assets.

Credit unions with low capitalization are at greater risk of disappearance. This could be because poorly capitalized credit unions have been inefficiently managed, and offer acquirers scope for introducing efficiency gains. Alternatively, it could be that low capitalization increases the attractiveness of the target to the acquirer.

Although the credit unions that disappeared had a higher proportion of non-performing loans, the share of non-performing loans in the loans portfolio does not appear to be an important factor in determining the hazard of acquisition, after controlling for other factors such as profitability and liquidity. Credit unions with relatively small loans portfolios appear to be attractive targets for acquirers who may believe they can earn an improved return in such cases. Using the ratio of non-interest expenses to assets as a crude managerial efficiency measure, there is some evidence that inefficient credit unions are more vulnerable to acquisition, although this relationship does not appear to be particularly strong or robust.

Finally, this paper has presented what we believe to be unique empirical evidence of a link between technological capability and the hazard of acquisition in financial services. During the period 2001 to 2006, when there was sustained growth in the uptake of internet technology, credit unions with no website were at the highest risk of acquisition, followed by those with informational, interactive and transactional websites. In other words, the risk of acquisition decreased as the level of website sophistication and capability increased. We therefore find support for the hypothesis that the

absence of an internet banking capability renders a credit union more vulnerable to acquisition, presumably by acquiring managers who have the technological capability and perceive that they can earn a higher return from the target credit union's assets.

References

Akerberg, D.A. and Gowrisankavan, G (2006) Quantifying equilibrium network externalities in the ACH banking industry, *Rand Journal of Economics*, 37, 738-761.

Akhavein, J.D., Berger, A.N. and Humphrey, D.B. (1997) The effects of mega mergers on efficiency and prices: Evidence from a bank profit function, *Review of Industrial Organization*, 12, 95-139.

Akhavein, J., Frame, S. and White, L.J. (2005) The diffusion of financial innovation: An examination of the adoption of small business credit scoring by large banking organizations, *Journal of Business*, 78, 577-596.

Altunbas, Y. and Ibáñez, D.M. (2007) Mergers and acquisitions and bank performance in Europe: The role of strategic similarities, *Journal of Economic and Business*, xx, xx-xx.

Al-Sharkas, A., Kabir Hassan, M. and Lawrence, S. (2008) The impact of mergers and acquisitions on the efficiency of the US Banking Industry: Further Evidence, *Journal of Business Finance and Accounting*, 35, 50-70.

Amel, D. and Rhoades, S. (1989) Empirical evidence on the motives for bank mergers, *Eastern Economic Journal*, 15, 17-27.

Amel, D., Barnes, C., Panetta, F. and Salleo, C. (2004) Consolidation and efficiency in the financial sector: A review of the international evidence, *Journal of Banking and Finance*, 28, 2493-2519.

Ashton, J.K. and Pham, K. (2007) Efficiency and price effects of horizontal bank mergers (June). Centre for Competition Policy Working Paper 07-9.

Barron, D.N., West, E. and Hannan, M.T. (1994) A time to grow and a time to die: growth and mortality of credit unions in New York city, 1914-1990, *American Journal of Sociology*, 100, 381-421.

Bech, M.L. and Hobijn, B. (2006) Technology diffusion in central banking, *Federal Reserve Bank of New York Staff Reports*, No. 260, September 2006.

Beitel, P., Schiereck, D. and Wahrenburg, M. (2004) Explaining M&A success in European banks, *European Financial Management*, 10, 109-139.

Berger, A.N., (1998) The efficiency effects of bank mergers and acquisition: A preliminary look at the 1990s data. In: Y. Amihud and G. Miller (eds.), *Bank Mergers and Acquisitions*, Kluwer Academic Publishers.

Berger, A.N. and Hannan, T.H. (1998) The efficiency cost of market power in the banking industry: A test of the quiet life and related hypotheses, *Review of Economics and Statistics*, 80, 454-465.

Berger, A. and Humphrey, D. (1992) Mega mergers in banking and the use of cost efficiency as an antitrust defense, *Antitrust Bulletin*, 37, 541-600.

Berger, A., Demsetz, R. and Strahan, P. (1999) The consolidation of the financial services industry: Causes, consequences and implications for the future, *Journal of Banking and Finance*, 23, 135-194

Berger, A.N., Kashyap, A.K. and Scalise, J.M. (1995) The transformation of the US banking industry: What a long strange trip it's been, *Brookings Papers on Economic Activity*, 2, 54-219.

Berger, A.N. and Mester, L.J. (1997) Inside the black box: What explains differences in the efficiencies of financial institutions? *Journal of Banking and Finance*, 21, 895-947.

Berkovitch, E. and Narayanan, M.P. (1998) Motives for takeovers: An empirical investigation, *Journal of Financial Economics*, 48, 347-362

Black, H. And Dugger, R.H. (1981) Credit union structure, growth and regulatory problems, *Journal of Finance*, 36, 529-538.

Bolt, W., Humphrey, D. and Uittenbogaard, R. (2008) Transaction pricing and the adoption of electronic payments: A cross-country comparison, *International Journal of Central Banking*, 4, 89-123.

Borzekowski, R. and Cohen, A. (2005) Estimating strategic complementarities in credit unions' outsourcing decisions, *Federal Reserve Board of Governors*, Working Paper.

Boyd, J.H., and Runkle, D.E. (1993) Size and the performance of banking firms: Testing the predictions of theory, *Journal of Monetary Economics*, 31, 47-67.

Broadbent, J.A. (1998) The bank merger wave: causes and consequences, *Federal Reserve Bank of Richmond Economic Quarterly*, 84/3, 1-11.

- Buch, C.M., De Long, G. (2004) Cross-border bank mergers: What lures the rare animal? *Journal of Banking and Finance*, 28, 2077-2102.
- Callahan Associates (2007) *2007 technology roundtable*. Callahan Associates.
- Campa, J. M. and Hernando, I. (2006) M&As performance in the European financial industry, *Journal of Banking and Finance*, 30, 3367-3392.
- Carbó S., Humphrey, D.B and Fernández, F. (2003) Bank deregulation is better than mergers, *Journal of International Financial Markets, Institutions and Money*, 13, 429-449.
- Collins, G. (2003) The economic case for mergers: Old, new, borrowed, and blue, *Journal of Economic Issues*, 37, 987-1009.
- Copeland, T.E., Weston, J.F. and Shastri, K. (2005), *Financial Theory and Corporate Policy*, 4th ed., Englewood Cliffs, New Jersey: Prentice Hall.
- Cornett, M.M., McNutt, J.J. and Tehranian, H. (2006) Performance changes around bank mergers: Revenue enhancements versus cost reductions, *Journal of Money, Credit and Banking*, 38, 1013-1051.
- Cox, D.R. (1972) Regression models and life tables, *Journal of the Royal Statistical Society Series B*, 34, 187-220.
- Courchane, M., Nickerson, D. and Sullivan, R. (2002) Investment in Internet banking as a real option: Theory and tests, *Journal of Multinational Financial Management*, 12, 347-363.
- Damanpour, F. (1991) Organizational innovations: A meta analysis of the determinants and moderators, *Academy of Management Journal*, 34, 555-590.
- Damanpour, F. (1992) Organizational size and innovation, *Organization Studies*, 13, 375-402.
- DeLong, G. and DeYoung, R. (2007) Learning by observing: Information spillovers in the execution and valuation of commercial bank M&As, *Journal of Finance*, 62, 181-217.
- Demsetz, R.S. and Strahan, P.E. (1997) Diversification, size, and risk at Bank Holding Companies, *Journal of Money, Credit, and Banking* 29, 300–313.
- DeYoung, R., (1997) Bank mergers, X-efficiency, and the market for corporate control, *Managerial Finance*, 23, 32-47

- DeYoung, R., Lang, W. and Nolle, D. (2007) How the internet affects the output and performance of community banks, *Journal of Banking and Finance*, 31, 1033-1060.
- Dow, J.P. (2007) The adoption of web banking at credit unions, *Quarterly Review of Economics and Finance*, 47, 435-448.
- Feinberg, R.M. (2001) The competitive role of credit unions in small local financial services markets, *Review of Economics and Statistics*, 83, 560-563.
- Feinberg, R.M., and Aatur Rahman, A.F.M. (2001) A causality test of the relationship between bank and credit union lending rates in local markets, *Economics Letters*, 71, 271-275.
- Focarelli, D., Panetta, F. and Salleo, C. (2002) Why do banks merge? *Journal of Money, Credit and Banking*, 34, 1047-1066..
- Fried, H.O., Lovell, C.A.K. and Yaisawarng, S. (1999) The impact of mergers on credit union service provision, *Journal of Banking and Finance*, 23, 237-386.
- Fuentes, R., Hernandez-Murillo, R. and Llobet, G. (2006) Strategic on-line banking adoption, *Federal Reserve Bank of St Louis Working Paper*.
- Furst, K., Lang, W.W. and Nolle, D.E. (2002) Internet banking, *Journal of Financial Services Research*, 22, 95-117.
- Goddard, J., and Wilson, J.O.S. (2005) US credit unions: An empirical investigation of size, age and growth, *Annals of Public and Cooperative Economics*, 76, 375-406.
- Goddard, J., McKillop, D., Wilson, J.O.S. (2002) The growth of US credit unions, *Journal of Banking and Finance*, 22, 2327-2356
- Goddard, J., McKillop, D.G., and Wilson, J.O.S. (2008a) The diversification and financial performance of US credit unions, *Journal of Banking and Finance*, 32, 1836-1849.
- Goddard, J., McKillop, D.G., and Wilson, J.O.S. (2008b) Prompt Corrective Action and the determinants of US credit union capital-assets ratios, University of St Andrews School of Management Working Paper.
- Goddard, J., Molyneux, P. and Wilson, J.O.S. (2004) Dynamics of growth and profitability in banking, *Journal of Money, Credit and Banking*, 36, 1069-1090.

- Goddard, J., Molyneux, P., Wilson, J.O.S. and Tavakoli, M. (2007) European banking: An overview, *Journal of Banking and Finance*, 31, 1911-1935.
- Gort, M. (1969) An economic disturbance theory of mergers, *Quarterly Journal of Economics*, 83, 624-642.
- Gorton, G., Kahl, M. and Rosen, R. (2006) Eat or be eaten: A theory of mergers and firm size, *Federal Reserve Bank of Chicago Working Paper*, WP2006-14.
- Goth, P and McKillop, D.G. and Ferguson, (2006), *Building Better Credit Unions*, Joseph Rowntree Foundation, The Policy Press, Bristol UK.
- Gowrisankavan, G. and Stavins, J. (2004) Network externalities and technology adoption, *Rand Journal of Economics*, 35, 260-276.
- Grabowski, R., Mathur, I. and Rangan, N. (1995) The role of takeovers in increasing efficiency, *Managerial and Decision Economics*, 16, 211-223
- Hadlock, C., Houston, J. and Ryngaert, M. (1999) The role of managerial incentives in bank acquisitions, *Journal of Banking and Finance*, 23, 221-249.
- Hannan, T.H. (2003) The impact of credit unions on the rates offered for retail deposits by banks and thrift institutions, *Board of Governors of the Federal Reserve System Working Paper 2003-6*.
- Hannan, T. and McDowell, J.M. (1984) The determinants of technology adoption: The case of the banking firm, *Rand Journal of Economics*, 15, 328-335.
- Hannan, T. and McDowell, J.M. (1986) Rival precedence and the dynamics of technology adoption: An empirical analysis, *Economica*, 54, 155-171.
- Hannan, T.H. and Piloff, S.J. (2006) Acquisition targets and motives in the banking industry, *Finance and Economics Discussion Series*, 2006-40. Federal Reserve Board.
- Hannan, T.H. and Rhoades, S. (1987) Acquisition targets and motives: The case of the banking industry, *Review of Economics and Statistics*, 69, 67-74.
- Hernando, I. and Nieto, M. (2007) Is the internet delivery channel changing banks' performance? *Journal of Banking and Finance*, 31, 1083-1099.

Houston, J.F., James, C.M. and Ryngaert, M.D. (2001) Where do merger gains come from? Bank mergers from the perspective on insiders and outsiders, *Journal of Financial Economics*, 60, 285-331.

Jones, K.D. and Critchfield, T. (2005) Consolidation in the US banking industry: Is the 'long, strange trip' about to end? *FDIC Banking Review*, 17, 31-61.

Knapp, M., Gart, A., and Becher, D. (2005) Post-merger performance of Bank Holding Companies, 1987-1998, *Financial Review*, 40, 549-574.

Kohers, T., and Mullis, D., (1987) Credit union size as a cause of different operating characteristics, *Mid-South Business Journal*, 28, 14-18.

Mansfield, E. (1961) Technical change and the rate of imitation, *Econometrica*, 29, 741-766.

Mansfield, E. (1969) Industrial research and development: Characteristics, costs and diffusion results *American Economic Review*, 59, 65-79.

McKillop, D.G., Goth, P. and Hyndman, N. (2006) *The Structure, Performance and Governance of Irish Credit Unions*, Gill and McMillan, Institute of Chartered Accountants in Ireland, Dublin, Ireland.

Mitchell, M.L and Mulherin, J.H. (1996) The impact of industry shocks on takeover and restructuring activity, *Journal of Financial Economics*, 41, 193-229.

Moore, R.R. (1997) Bank acquisition determinants: Implications for small business credit, *Federal Reserve Bank of Dallas*, April.

National Credit Union Administration (2006a) 2006 Annual Report. NCUA.

National Credit Union Administration (2006b) Measuring service to members, *NCUA letter to credit unions*, Number 06-FCU-02. NCUA.

Nickerson, D. and Sullivan, R.J. (2003) Financial innovation, strategic real options and endogenous competition: Theory and tests, *Journal of Multinational Financial Management*, 12, 347-363.

Nolle, D.E. (1995) Banking industry consolidation: past changes and implications for the future, *Economic and Policy Analysis Working Paper 95-1*. Office of the Comptroller of Currency.

Ono, Y. and Stango, V. (2005) Outsourcing, firm size, and product complexity: Evidence from credit unions, *Federal Reserve Bank of Chicago Economic Perspectives*, 1st Quarter, 1-11.

Park, K. and Pennacchi, G. (2007) Harming depositors and helping borrowers: The disparate impact of bank consolidation, *Federal Reserve Bank of Cleveland*, Discussion Paper, 2007-04.

Peristiani, S. (1997) Do mergers improve the X-efficiency and scale efficiency of US banks? Evidence from the 1980s, *Journal of Money Credit Banking*, 29, 326–337.

Pozzolo, F. and Focarelli, D. (2007) Cross-border M&As in the financial sector. Is banking different from insurance? *Bank of Italy Working Paper*.

Ralston, D., Wright, A., and Garden, K. (2001) Can mergers ensure the survival of credit unions in third millennium, *Journal of Banking and Finance*, 25, 2277-2304.

Rhoades, S.A. (1986) The operating performance of acquired firms in banking before and after acquisition, *Staff Study Number 149*, US Federal Reserve Board.

Rhoades, S.A. (1998). The efficiency effects of bank mergers: An overview of case studies of nine mergers, *Journal of Banking and Finance*, 22, 273-291

Roll, R. (1986) The hubris hypothesis of corporate takeovers, *Journal of Business*, 59, 197-216.

Rossi, S., and Volpin, P. (2004) Cross-country determinants of mergers and acquisitions, *Journal of Financial Economics*, 74, 277-304.

Saloner, G. and Shepard, A. (1995) Adoption of technologies with network effects: An empirical examination of the adoption of Automated Teller Machines, *Rand Journal of Economics*, 26, 479-501.

Schmid, F. (2005) When for-profits and not-for profits compete: Theory and empirical evidence from retail banking, *Managerial Finance* 31, 50-71.

Smythe, D.J. (2001) The great merger movement and the diffusion of electric power utilization in American manufacturing, 1899-1909, *Eastern Economic Journal*, 27, 253-266.

Spindt, P.A. and Tarhan.V. (1992) *Are there synergies in bank mergers?* Working Paper, Tulane University: New Orleans.

Sullivan, R. and Wang, Z. (2005) Internet banking: An exploration in technology diffusion and impact, *Payments System Research Department*, Federal Reserve Bank of Kansas City, Working Paper 05-05.

Tokle, R.J. and Tokle, J.G. (2000) The influence of credit union and savings and loan competition on bank deposit rates in Idaho and Montana, *Review of Industrial Organization*, 17, 427-439.

- US Government Accountability Office (2005) *Financial institutions: Issues regarding the tax exempt status of credit unions*, GAO-06-220T. Washington DC: Government Accountability Office.
- Wheelock, D.C. and Wilson, P.W. (2000) Why do banks disappear? The determinants of US bank failures and acquisitions, *Review of Economics and Statistics*, 82, 127-138.
- Wheelock, D.C. and Wilson, P.W. (2004) Consolidation in US banking: Which banks engage in mergers? *Review of Financial Economics*, 13, 7-39.
- Wilcox, J.A. (2006) *Credit union conversion to banks: Facts, incentives, issues and reforms*, Filene Research Institute.
- Wilcox, J.A. (2007) Credit unions, conversions, and capital, *Federal Reserve Bank of San Francisco Economic Letter*, Number 2007-16, June 22, 2007.
- Worthington, A.C. (2004) Determinants of merger and acquisition activity in Australian cooperative deposit taking institutions, *Journal of Business Research*, 57, 47-57.
- Zhang, W. (1995) Wealth effects of US bank takeovers, *Applied Financial Economics*, 5, 329-336.

Table 1 Summary statistics: Time-varying covariates

	Mean	St. Dev.	Correlation coefficients						
			ASSET	MEMPOT	ROA	LIQ	CAPASS	LOANASS	NONPER
ASSET	64.8	333.6	-	-	-	-	-	-	-
MEMPOT	.4761	.2702	-.0570	-	-	-	-	-	-
ROA	.00289	.01066	.0312	-.0022	-	-	-	-	-
LIQ	.1513	.1377	-.0916	.0821	-.0577	-	-	-	-
CAPASS	.1363	.0604	-.0882	.1924	.0592	.1333	-	-	-
LOANASS	.5750	.1792	.0677	-.1466	.0494	-.3010	-.2047	-	-
NONPER	.0233	.0471	-.0664	.0511	-.1189	.2325	.1653	-.1646	-
NINTASS	.00392	.00609	.0528	-.2058	.2686	-.0204	-.1366	.1604	-.0588

Note:

ASSET = total assets; MEMPOT = actual members / potential members; ROA (return on assets) = net income / total assets; AGE = current year – year of formation; LIQ = (cash on hand + cash on deposit + cash equivalents) / total assets; CAPASS (capital-to-assets ratio) = net worth / total assets; LOANASS = total loans / total assets; NONPER = non-performing loans / total loans; NINTASS = non-interest expenses / total assets

Table 2 Summary statistics: Non-time-varying covariates

	All sample credit unions	Acquired credit unions
Distribution by charter type		
State charter	.3886	.4032
Federal charter	.6114	.5968
Distribution by common bond type		
Single common bond	.5003	.5949
Multiple common bond	.4997	.4051
Distribution by year of formation		
- 1930	.0203	.0115
1931-1940	.2030	.1586
1941-1950	.1129	.1140
1951-1960	.3308	.3357
1961-1970	.1897	.2096
1971-1980	.1036	.1325
1981-	.0397	.0382

Table 3 Mean values of time-varying covariates by observation: All sample credit unions

	Number	ASSET	MEMPOT	ROA	LIQ	CAPASS	LOANASS	NONPER	NINTASS	TECH0	TECH1	TECH2	TECH3
Jun-01	9511	47.2	.5172	.00389	.1549	.1390	.6190	.0221	.00362	.5871	.1698	.0613	.1818
Dec-01	9368	50.3	.5105	.00288	.1577	.1374	.6014	.0241	.00363	.5572	.1732	.0575	.2120
Jun-02	9213	55.0	.5020	.00277	.1630	.1317	.5688	.0225	.00329	.5279	.1688	.0500	.2532
Dec-02	9097	57.9	.4940	.00333	.1564	.1346	.5707	.0247	.00379	.5003	.1660	.0450	.2888
Jun-03	8948	63.3	.4860	.00319	.1881	.1304	.5384	.0242	.00363	.4714	.1616	.0412	.3258
Dec-03	8793	65.7	.4752	.00217	.1634	.1331	.5529	.0249	.00389	.4505	.1514	.0388	.3594
Jun-04	8655	69.5	.4660	.00272	.1565	.1322	.5457	.0228	.00383	.4307	.1453	.0393	.3846
Dec-04	8480	72.4	.4543	.00227	.1410	.1361	.5643	.0236	.00428	.4083	.1426	.0376	.4116
Jun-05	8349	76.1	.4461	.00304	.1314	.1378	.5684	.0223	.00425	.3865	.1361	.0378	.4396
Dec-05	8197	78.9	.4383	.00218	.1206	.1434	.5956	.0239	.00466	.3704	.1155	.0384	.4757
Jun-06	8067	82.9	.4308	.00324	.1229	.1453	.5974	.0209	.00448	.3512	.1069	.0366	.5054

Note:

ASSET = total assets; MEMPOT = actual members / potential members; ROA (return on assets) = net income / total assets;

AGE = current year – year of formation; LIQ = (cash on hand + cash on deposit + cash equivalents) / total assets; CAPASS (capital-to-assets ratio) = net worth / total assets; LOANASS = total loans / total assets; NONPER = non-performing loans / total loans; NINTASS = non-interest expenses / total assets. TECH0 is the proportion of sample credit unions with no website. TECH1 is the proportion with an informational website only. TECH2 is the proportion with an interactive website. TECH3 is the proportion with a transactional website.

Table 4 Mean values of time-varying covariates by observation: Sample credit unions that were acquired during the subsequent six-month period

	Number	ASSET	MEMPOT	ROA	LIQ	CAPASS	LOANASS	NONPER	NINTASS	TECH0	TECH1	TECH2	TECH3
Jun-01	143	11.0	.5303	-.00469	.2013	.1424	.5930	.0357	.00271	.8112	.0979	.0210	.0699
Dec-01	155	5.6	.5471	-.01292	.2145	.1439	.5598	.0566	.00278	.8516	.0710	.0065	.0710
Jun-02	116	7.4	.5470	-.00470	.2439	.1400	.5514	.0418	.00226	.8103	.0776	.0345	.0776
Dec-02	149	11.0	.5030	-.00760	.2340	.1470	.5187	.0619	.00313	.7651	.1275	.0403	.0671
Jun-03	155	9.4	.5007	-.01134	.2948	.1409	.4688	.0571	.00267	.7935	.1032	.0387	.0645
Dec-03	138	9.7	.5119	-.00866	.2254	.1348	.5033	.0530	.00254	.7391	.1377	.0217	.1014
Jun-04	175	6.7	.4997	-.00835	.2679	.1450	.4705	.0496	.00404	.7486	.0800	.0229	.1486
Dec-04	131	8.5	.4419	-.01101	.2090	.1354	.5382	.0463	.00331	.7176	.1450	.0305	.1069
Jun-05	152	12.6	.4444	-.00875	.2204	.1335	.5212	.0403	.00301	.6711	.0855	.0197	.2237
Dec-05	130	9.5	.4993	-.01570	.1909	.1494	.5419	.0533	.00332	.5769	.1692	.0385	.2154
Jun-06	126	34.1	.4401	-.01807	.1842	.1470	.5219	.0346	.00188	.6349	.0952	.0317	.2381

Note:

ASSET = total assets; MEMPOT = actual members / potential members; ROA (return on assets) = net income / total assets; AGE = current year – year of formation; LIQ = (cash on hand + cash on deposit + cash equivalents) / total assets; CAPASS (capital-to-assets ratio) = net worth / total assets; LOANASS = total loans / total assets; NONPER = non-performing loans / total loans; NINTASS = non-interest expenses / total assets. TECH0 is the proportion of sample credit unions with no website. TECH1 is the proportion with an informational website only. TECH2 is the proportion with an interactive website. TECH3 is the proportion with a transactional website.

Table 5 Hazard function estimation results

	All	State	Federal	Single	Multiple
LASSET	-.2902*** (-13.81)	-.3645*** (-11.16)	-.2708*** (-9.62)	-.2410*** (-9.14)	-.4422*** (-11.97)
MEMPOT	-.2667*** (-2.65)	-.4999*** (-3.17)	-.2131 (-1.60)	-.2411* (-1.84)	-.4647*** (-2.90)
LAGE	.2498*** (3.48)	.1689 (1.64)	.2734*** (2.75)	.1733* (1.88)	.3915*** (3.38)
ROA	-11.0224*** (-24.82)	-10.0886*** (-12.21)	-13.3798*** (-21.44)	-13.4540*** (-20.63)	-9.9929*** (-11.78)
LIQ	.9653*** (6.34)	.6422*** (2.56)	1.0930*** (5.67)	.6824*** (3.66)	1.4717*** (5.30)
CAPASS	-2.8197*** (-6.69)	-3.6071*** (-5.04)	-2.5956*** (-4.99)	-1.8598*** (-3.94)	-6.1218*** (-7.20)
NONPER	.0519 (0.17)	1.7741*** (3.25)	-.7175* (-1.86)	.2657 (0.79)	.4899 (0.68)
LOANASS	-.3740*** (-2.64)	-.4150* (-1.81)	-.3117* (-1.72)	-.1850 (-1.06)	-.7981*** (-3.22)
NINTASS	8.5057*** (3.44)	17.8467*** (3.40)	-1.3902 (-0.28)	-1.3754 (-0.27)	13.0696*** (3.85)
TECH1	-.3524*** (-3.92)	-.2204 (-1.51)	-.4044*** (-3.55)	-.3680*** (-2.85)	-.2211* (-1.75)
TECH2	-.4748*** (-2.90)	.0525 (0.24)	-1.2677*** (-4.49)	-1.0516*** (-3.51)	-.2056 (-0.96)
TECH3	-.6863*** (-6.86)	-.4947*** (-3.22)	-.7826*** (-5.88)	-.7676*** (-5.07)	-.4100*** (-2.90)
FED	-.1734*** (-3.29)	-	-	-.2098*** (-3.02)	-.0858 (-1.04)
MULT	.0854 (1.54)	.0368 (0.44)	.1391* (1.84)	-	-
Observations	96678	37361	59317	47575	49103
Credit unions	9511	3696	5815	4758	4753
Disappearances	1570	633	937	934	636

Note:

ASSET = total assets; MEMPOT = actual members / potential members; ROA (return on assets) = net income / total assets; AGE = current year – year of formation; LIQ = (cash on hand + cash on deposit + cash equivalents) / total assets; CAPASS (capital-to-assets ratio) = net worth / total assets; LOANASS = total loans / total assets; NONPER = non-performing loans / total loans; NINTASS = non-interest expenses / total assets. TECH0 is the proportion of sample credit unions with no website. TECH1 is the proportion with an informational website only. TECH2 is the proportion with an interactive website. TECH3 is the proportion with a transactional website. FED is a dummy to distinguish between credits unions with a federal or state charter; MULT is a dummy to distinguish between credit unions with either a single or multiple common bond.

*** Estimated coefficient significantly different from zero, two-tail test, 1% significance level. ** As above, 5% significance level. * As above, 10% significance level.