# US credit unions: survival, consolidation and growth

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# US Credit Unions: Survival, Consolidation and Growth

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**Abstract**

This study uses hazard function estimations and time-series and cross-sectional growth regressions to examine the impact of exit through merger and acquisition (M&A) or failure, and internally-generated growth, on the firm-size distribution within the US credit union sector. Consolidation through M&A was the principal cause of a reduction in the number of credit unions, but impact on concentration was small. Divergence between the average internally-generated growth of smaller and larger credit unions was the principal driver of the rise in concentration.

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## I. INTRODUCTION

In banking and financial services, industry structure characterized by the firm-size distribution is a key determinant of the nature of competition. Competition among financial services providers has, in turn, implications for consumer welfare, and for the stability or fragility of the financial system. In the US credit union sector, as in banking and financial services generally, a tendency for concentration to increase was apparent in many developed countries throughout the 1980s, 1990s and 2000s.[1]

This study examines the contribution of exit and the internally-generated growth of established firms to changes in industry structure and the rise in concentration in the US credit union sector. Changes to the membership of the population of firms through exit occurs as a result of corporate failure, or a merger and acquisition (M&A) transaction in which an established firm is acquired by another industry member. Variation between firms in patterns of internally-generated growth leaves the population membership unchanged, but alters the relative shares of firms in total industry assets. If firm-level growth rates are correlated with firm size, the link between internally-generated growth and concentration is self-evident. According to Gibrat's Law (Gibrat, 1931), also known as the Law of Proportionate Effect, even if growth and size are uncorrelated, and the factors that influence the firm's growth such as customer demand, managerial talent, innovation or organisational structure, are randomly distributed across firms, there is a natural tendency for concentration to increase over time and for the firm size distribution to become increasingly skewed.[2]

Structural and conduct deregulation, technological and financial innovation, and changes in the economic environment, enabled many US credit unions to expand their scale of operations significantly during the 1990s and 2000s. In 2010 credit unions accounted for around 10% of consumer savings and deposits in the US, and provided financial services to more than 90 million members.[3] In common with commercial banking, the credit union sector has undergone large-scale consolidation.[4] The number of credit unions declined from 14,549 in 1990 to 7,334 in 2010. A few new credit unions were formed, while many more disappeared through either acquisition or failure. At the end of 2010, 167 US credit unions reported assets in excess of $1bn and loan portfolios similar in structure to that of a medium-sized commercial bank.[5]

This study provides an integrated analysis of corporate demographics for the US credit union sector for the period 1994-2010. There are several important insights with respect to the drivers of acquisition and failure. Smaller credit unions are at higher risk of acquisition or failure than their larger counterparts. Older credit unions that are similar in size to younger credit unions are more likely to be acquired, but the failure probability is not age-dependent. Credit unions holding a high proportion of liquid assets, those with low loans-to-assets ratios, and those with low profitability, are at increased risk of exit through acquisition or failure. Highly capitalized credit unions are at increased risk of acquisition.

This study also provides insights into the evolution of industry structure for the US credit union sector. Consolidation through M&A has greatly reduced the population size, but the impact on concentration has been modest, owing to the relatively small average asset size of acquired credit unions. Internally-generated growth is shown to be the main driver of the trend towards increased concentration. Interpreted as a descriptor of the dynamics of the size-growth relationship for each credit union individually, Gibrat's Law accurately describes the growth of credit unions at the upper end of the asset size distribution; but for many of the smaller credit unions Gibrat's Law is rejected in favour of a stationary alternative hypothesis. Interpreted as a descriptor of the cross-sectional size-growth relationship Gibrat's Law is unequivocally rejected, with larger credit unions consistently experiencing faster average growth than their smaller counterparts. This divergence between the average growth of large and small credit unions is the principal cause of the increase in concentration.

In the previous literature on credit union failure, Smith and Woodbury's (2010) comparative study of US banks and credit unions suggests credit unions are less exposed than banks to fluctuations in the business cycle. Elsewhere, it has been shown that small or weakly capitalized credit unions are among those most at risk of failure. Other factors that increase the failure hazard include poorly trained management, lax lending standards and weak collection operations, poor record-keeping, and the closure of sponsoring companies (Kharadia and Collins, 1981; Gordon, 1987; US Government Accountability Office, 1991; Barron et al., 1994; Pille and Paradi, 2002; Wilcox, 2005). In respect of credit union M&A, Goddard et al. (2009) find the hazard of acquisition for US credit unions during the period 2001-06 is inversely related to asset size and profitability, and positively related to liquidity. Worthington (2004) finds asset size, asset management, liquidity and regulatory variables influenced significantly the probability of Australian credit unions engaging in M&A during the period 1992-95.[6]

Barron et al. (1994) investigate the growth of state-chartered credit unions in New York City for the period 1914-90, by analyzing the effects of organizational age, size, and population density on the rates of failure and growth. Old and small institutions were more likely to fail, while young and small institutions had the highest growth rates. Goddard et al. (2002) test Gibrat's Law for US credit unions, using data for the period 1990-99. Larger credit unions grew faster than smaller ones. On average, credit unions with above-average growth in one period experienced below-average growth in the following period. Small credit unions exhibited more variable growth than large credit unions. More recently, Wheelock and Wilson (2011) report evidence of increasing returns to scale among US credit unions of all sizes for the period 1989-2006. They anticipate that continued deregulation, allowing credit unions to expand their scale or scope of financial service provision, would encourage further growth at the upper end of the size distribution.

The econometric analysis reported in this study comprises a panel estimation of hazard functions for the determinants of acquisition or failure, and two sets of time-series and cross-sectional estimations of the relationship between asset size and internally-generated growth. This study extends and integrates previous empirical analysis of credit union acquisition (Goddard et al., 2009), and the dynamics of credit union growth (Goddard et al., 2002). The Goddard et al. (2009) study of disappearance through acquisition is extended by estimating a competing-risks model that comprises separate hazard functions for the incidence of firm disappearance through both acquisition and failure. The implications of population changes through acquisition and failure for the long-term trend in concentration are also explored.

The present analysis of growth also offers several improvements on the cross-sectional and panel analysis of credit union growth during the 1990s reported by Goddard et al. (2002). In order to focus exclusively on internally-generated growth (as opposed to growth by means of acquisition) in the cross-sectional analysis, the lagged size and lagged growth covariates of any credit union that was an acquirer are adjusted by defining the lagged values for a 'synthetic' credit union constructed using the aggregate assets of the acquirer and the acquired credit union as separate entities at the relevant data-points. Survivorship bias in the cross-sectional growth regressions is addressed by correcting for violation of the conditions for valid estimation and inference resulting from statistical dependence between growth and survival. The Heckman sample-selection model provides a framework for integrating the analyses of growth, and disappearance through acquisition or failure.

The paper proceeds as follows. Section II describes the US credit union sector. Section III reports an empirical analysis of the determinants of exit through acquisition or failure. Section IV reports an empirical analysis of patterns of survivorship and internally-generated growth. Finally, Section V summarizes and concludes.

## II. THE US CREDIT UNION SECTOR

The US credit union data are compiled from the '5300 Call Reports', published by the National Credit Union Association (NCUA). Semi-annual data are available for the period June 1994 to December 2010. These data are augmented with information (provided by the NCUA in response to several Freedom of Information requests) on entrants and exits. Attrition is tracked to an exceptional degree of accuracy, with a cause of disappearance identified for 99.5% of all exits. The acquiring credit union is identified for 98.8% of credit unions that exited as a result of M&A, and acquisitions account for 89.9% of all exits.

Table 1 (panel A) reports the total number of US credit unions at the end of December from 1994 to 2010, and an analysis of the evolution of the distribution of the population by asset size. In each year, the population is subdivided into five asset size classes, defined in real terms as follows: class 1, assets below $2m in 1994 prices (all price conversions are based on the US GDP deflator); class 2, assets between $2m and $6m; class 3, $6m to $18m; class 4, $18m to $54m; class 5, assets above $54m. This analysis indicates that there has been a marked shift in the composition of the population by asset size, owing to a combination of consolidation through acquisition and failure, and differences between the average internally-generated growth of small and large credit unions. In 1994, for example, class 1 accounted for 31.6% of the entire population, and class 5 accounted for 9.0%. In 2010, the corresponding figures were 16.6% for class 1 (assets below $2.8m in current prices) and 22.6% for class 5 (assets above $74.9m in current prices).

The shift in the asset size distribution has been encouraged by several developments in regulation and fiscal treatment, which have contributed to a tendency for the larger credit unions to offer portfolios of financial services resembling those of medium-sized commercial banks.[7] The NCUA revised the field of membership rules in 1994, diluting the common bond and permitting credit unions to add occupational groups of up to 100 persons without regulatory approval. The 1998 Credit Union Membership Access Act (CUMAA) permitted federal credit unions to add select employee groups (SEGs) to their fields of membership. In some cases a credit union's common-bond designation makes it difficult to add SEGs, and some credit unions converted from occupational to residential common bonds in order to expand their membership base.[8]

Owing partly to the restrictions on their activities and their high capitalization, credit unions have, in general, withstood the current financial crisis better than many banks (Smith and Woodbury, 2010). The crisis in the real-estate market has impacted on the credit union sector, primarily through the investment policies of a number of corporate credit unions,[9] which used cash deposits received from retail credit unions to purchase risky asset-backed securities, and realized large losses in several cases. The 2010 Dodd-Frank Act made radical changes to financial services regulation and supervision. For credit unions, deposit insurance was increased from $100,000 to $250,000 per account, and the supervision of corporate credit unions was strengthened.[10]

Table 2 reports a further analysis of the dynamics of change in the asset size distribution, in the form of a set of empirical yearly rates of transition between each size class and the nearest adjacent classes, and exit rates from each size class. The size classes are the same as those used to construct Table 1, and the computations follow closely the methodology used by Robertson (2001) in a similar analysis of transition rates between asset size classes for US banks over the period 1960-2000. The numbers of credit unions moving by more than one size class in any year are negligible, and the corresponding rates of transition are not reported. Table 2 indicates that there is a high degree of stability in the asset size distribution from year to year. The propensities for credit unions to remain within the same asset size class are, in general, higher on average than those reported by Robertson

(2001) for banks, particularly among the larger size classes.[11] The propensity to remain within the same class is an increasing function of size, and this relationship appears to be driven mainly by an inverse relationship between size and the propensity to exit. The exit rate in the two largest size classes appears to have risen significantly over the observation period. The year 2008-09 witnessed unusually high rates of upward transition from each of classes 1 to 4 to the next highest class (2 to 5, respectively), apparently due to unusual patterns of consolidation at the height of the late-2000s financial crisis.

Consistent with the analysis presented by Robertson (2001), Table 1 (panel B) reports projections of future changes in the asset size distribution over the period 2011-15, based on the assumption that the yearly entry, transition and exit rates observed over the final year included in Table 2, 2009-10, remain unchanged for the following five years. The projected size distribution for 2011 is obtained by multiplying a matrix containing the transition and exit rates for each size class by a vector containing the numbers of credit unions in each class in 2010, and adding five new entrants to class 1 (equivalent to the actual number of entrants in 2010, all of which joined class 1). The projections for subsequent years are then obtained iteratively, by multiplying the same matrix by a vector containing the projected numbers for the preceding year. The projections suggest further shrinkage in the population and shifts in the shape of the size distribution, with the projected number of credit unions in the smallest size class dropping by a further 23.4% over a five-year period, while the projected number in the largest size class drops by only 2.2%.

Table 3 reports an analysis of changes in the population owing to entry and exit. Between December 1994 and December 2010, the total number of credit unions fell from 12,051 to 7,334. This decline in numbers reflects the net effect of entry (156 new credit unions) and exit (4,873 credit unions). A large majority of the credit unions that exited did so as a consequence of having been acquired (4,382 credit unions, or 89.9% of the total number that exited). The exit rate was remarkably stable throughout the 2000s (between 3% and 4% per year), and the exit rate does not appear to be sensitive to the economic cycle. Smith (2012) reports that on conservative estimates, credit union loan portfolios were around 25% less sensitive to macroeconomic shocks than bank loan portfolios.

## III. EMPIRICAL ANALYSIS OF EXIT THROUGH ACQUISITION OR FAILURE

Section III reports an investigation of the determinants of credit union disappearance through acquisition or failure during the period 1994-2010.

### Empirical Model for the Determinants of Acquisition or Failure.

The hazard function estimations reported in this section are based on the method used by Wheelock and Wilson (2000) to model the hazards of failure and acquisition for US banks. The empirical model is the Cox (1972) proportional hazard model with time-varying covariates. The probabilities of disappearance through events defined as failure and acquisition are modelled separately, using a competing-risks framework. The alternative modes of disappearance are treated as independent events, and the observations on a credit union that disappeared through each event are treated as right-censored in the estimations of the hazard for disappearance through the other event.

The hazard function expressing the probability that credit union i disappears through event k between time t and time t+1 (k=1 denotes acquisition; k=2 denotes failure), conditional on a vector of covariates specific to credit union i at time t that influence the probability of event k, denoted $x_{k,i}(t)$, is modelled as follows:

$$\lambda_{k,i}(t \mid x_{k,i}(t), \beta_k) = \bar{\lambda}_k(t)\exp(x_{k,i}(t)'\beta_k) \qquad [1]$$

In [1], the baseline hazard is denoted $\bar{\lambda}_k(t)$, and $\delta_k$ is a vector of coefficients to be estimated. The time-index t is measured in calendar time elapsed since December 1994. $R_t$

denotes the set of credit unions that are in existence at time t and exposed to risk of disappearance between t and t+1, and $D_{k,t}$ denotes the set of $d_{k,t}$ credit unions that disappear through event k between time t and time t+1. The contribution to the partial likelihood function of credit union i, which disappears through event k between t and t+1, is:

$$\exp(x_{k,i}(t)'\delta_k) / \sum_{j \in R_t} \exp(x_{k,j}(t)'\delta_k) \qquad [2]$$

The baseline hazard $\bar{\lambda}_k(t)$ drops out of the partial likelihood function, and is not parameterized explicitly. The (semi-parametric) log-partial likelihood function is:

$$\ln[L(\delta_k)] = \sum_{t=1}^{T}[\sum_{i \in D_{k,t}} x_{k,i}(t)'\delta_k - d_{k,t} \ln\{\sum_{j \in R_t} \exp(x_{k,j}(t)'\delta_k)\}] \qquad [3]$$

The hazard function covariate definitions are as follows: $S_{i,t}$ = Total Assets; $K_{i,t}$ = capital-to-assets ratio = Net Worth /Total Assets; $Q_{i,t}$ = Liquid Assets / Total Assets; $N_{i,t}$ = Non-performing Loans / Total Assets; $L_{i,t}$ = Loans / Total Assets; $E_{i,t}$ = Non-interest Expenses / Total Assets; $R_{i,t}$ = Return on Assets; and $A_{i,t}$ = Age. Table 4 reports the mean values of each of the covariates at the end of each year. In the empirical hazard functions, logarithmic transformations are applied to the total assets and age covariates.

<u>Estimation Results</u>.

Table 5 reports the empirical hazard function estimation results. All members of the credit union population are included in the estimations (see the final column of Table 1). The acquisition hazard function is based on 4,471 credit unions reported in Table 3 as exits through either acquisition or purchase and assumption. The failure hazard function is based on 341 credit unions reported in Table 3 as exits through liquidation. Observations on credit unions that exited for reasons other than acquisition, purchase and assumption or liquidation are treated as right-censored.

The anticipated inverse relationship between asset size and the hazard of disappearance is evident in both of the hazard function estimations, indicating that a smaller credit union was at significantly greater risk of disappearance through either acquisition or failure than a larger one. The coefficient on the age covariate in the M&A hazard is positive and significant, suggesting that an older credit union is more likely to be acquired than a younger credit union of the same size. The coefficient on the age covariate is insignificant in the failure hazard.

The coefficients on the capital-to-assets ratio covariate are negative and significant in the M&A hazard, and positive and significant in the failure hazard. These results are consistent with Hannan and Piloff's (2009) explanation for a negative relationship between the capitalization of US banks and the hazard of acquisition: high capitalization is a proxy for efficiency, indicating limited scope for post-merger efficiency gains, while low capitalization reduces the purchase price and increases the attractiveness of the target. Contrary to results reported by Wilcox (2005), highly capitalized credit unions appear to be at greater risk of failure. Credit unions regarded as inadequately capitalized under Section 301 of CUMAA (1998) are subject to a range of mandatory actions, such as earnings retentions, lending restrictions and the prohibition of increases in assets.[12] These actions impact on both the denominator and the numerator of the capital-to-assets ratio, sometimes causing the latter to spike for a distressed credit union immediately prior to failure. It is also the case that smaller credit unions maintain a higher capital-to-assets ratio on average than large credit unions, and small credit unions are at higher risk of failure. Although $x_{2,i}(t)$ includes a separate control for asset size, it is possible that the positive coefficient on $K_{i,t}$ in the failure hazard also reflects aspects of the strong association between asset size and failure.

The coefficients on the liquidity ratio covariate are positive and significant in both hazards. The coefficient on the loans-to-assets ratio covariate is insignificant in the M&A

hazard, but the corresponding coefficient is negative and significant in the failure hazard. A credit union that hordes cash, or does not create a loans portfolio of a size commensurate with its deposits, may be either an attractive target for an acquirer that believes itself capable of earning a higher return by expanding the loans portfolio, or at risk of failure due to an inability to generate an adequate return.

The coefficient on the non-performing loans covariate in the M&A hazard is negative and significant, while the corresponding coefficient in the failure hazard is positive and significant. These coefficients suggest a lack of control over the quality of lending makes a credit union a less attractive target for acquisition, but increases the likelihood of disappearance through failure. The coefficient on the ratio of non-interest expenses to assets covariate in the M&A hazard is positive and significant. This appears 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 either acquisition. The corresponding coefficient in the failure hazard is insignificant. Finally, the coefficients on the return on assets covariate are negative and significant in both hazards, indicating that the likelihood of disappearance through either acquisition or failure is reduced by an increase in profitability.

Impact of Consolidation on Industry Structure.

Table 6 reports a descriptive analysis of the trend in concentration over the period 1994-2010. The first five columns report five-, ten- and twenty-firm concentration ratios, together with the Herfindahl-Hirshman Index (HHI) and the HHI Numbers Equivalent. Consistent with the patterns reported in Table 1, these data indicate a trend towards increased concentration that has been remarkably steady and consistent over time.

The final two columns of Table 6 provide an indication of the contribution of consolidation through M&A to the trend in concentration, in the form of a 'counterfactual' HHI based on hypothetical population data. For the purposes of calculating the counterfactual HHI, each acquired credit union is assumed to have continued to operate as a separate entity to the end of 2010. A proportion of the combined assets of the acquirer at each data-point after the merger took place is reallocated to the (counterfactually surviving) acquired credit union. The proportion of the assets reallocated is based on the relative asset sizes of the acquirer and the acquired at the data point immediately preceding the merger: the final data point at which separate assets data are available for both institutions.

The large number of credit union mergers notwithstanding, the analysis reported in Table 6 suggests that the contribution of M&A to the rise in concentration was modest. The counterfactual 2010 HHI of 43.8 is only slightly smaller than the observed HHI of 46.5; and the observed drop in the HHI Numbers Equivalent from 520.9 in 1994 to 215.2 in 2010 would have been mitigated only marginally, to a counterfactual figure of 228.5 in 2010, had no credit unions mergers taken place between 1994 and 2010. The disparity between the large effect of M&A on the population size, and the much smaller effect on concentration, is attributed to the majority of acquired credit unions having been drawn from the lower end of the asset size distribution.

## IV EMPIRICAL ANALYSIS OF INTERNALLY-GENERATED GROWTH

The empirical analysis reported in Section III suggests that while consolidation through M&A accounts for most of the large decline in the number of US credit unions over the period 1994-2010, the effect on industry structure was relatively small. With the sector also having experienced modest rates of entry and failure, it appears that internally-generated growth was the main driver of the trend towards increased concentration over the same period. Section IV reports an empirical analysis of the relationship between credit union size and growth, using Gibrat's Law as a benchmark.

Empirical Analysis of the Relationship Between Firm Size and Growth.

The empirical analysis of the firm size-growth relationship is based on the following general model specification:

$$(s_{i,t} - s_{i,t-1}) = \phi_{0,i,t} + \phi_{1,i,t} s_{i,t-1} + \sum_{j=1}^{m_{i,t}} \phi_{2,j,i,t}(s_{i,t-j} - s_{i,t-j-1}) + \phi_{3,i,t} t + u_{i,t} \qquad [4]$$

In [4], logarithmic growth over a one-year period is the dependent variable, and log size at the start of the period and growth over $m_{i,t}$ previous one-year periods are the explanatory variables.

Clearly, estimation requires the imposition of restrictions on the coefficients of [4]. Below, two sets of restrictions are considered. Under the first set, it is assumed that the coefficients are constant over time, but variable over all surviving i for which a complete set of time-series observations is available, so that $\phi_{1,i,t} = \alpha_{1,i}$ for all t (with similar restrictions imposed on the other coefficients, and $m_{i,t}=m_i$). These restrictions are embodied in a set of individual Dickey-Fuller time-series regressions (for each i=1,...,N, where N is the number of surviving credit unions), defined as follows:

$$(s_{i,t} - s_{i,t-1}) = \alpha_{0,i} + \alpha_{1,i} s_{i,t-1} + \sum_{j=1}^{m_i} \alpha_{2,j,i}(s_{i,t-j} - s_{i,t-j-1}) + \alpha_{3,i} t + u_{i,t} \qquad [5]$$

Each regression in [5] has t=1,...,T observations. The focus is on the dynamics of the size-growth relationship for each credit union individually. As the credit union grows in size (possibly relative to a deterministic time-trend or drift component), either growth might tend to decline ($\alpha_{1,i}<0$), or growth might be independent of attained size ($\alpha_{1,i}=0$).[13] The latter case $\alpha_{1,i}=0$ represents Gibrat's Law, interpreted as a descriptor of the dynamics of the size-growth relationship for each credit union individually.

Under the second set of restrictions, it is assumed that the coefficients are the same for all i but variable over time, so that $\phi_{1,i,t} = \beta_{1,t}$ for all i (with similar restrictions imposed on the other coefficients, and $m_{i,t}$=1 for all i,t). A series of cross-sectional regressions (for each t=1,...,T) is defined as follows:

$$(s_{i,t} - s_{i,t-1}) = \beta_{0,t} + \beta_{1,t}s_{i,t-1} + \beta_{2,t}(s_{i,t-1} - s_{i,t-2}) + u_{i,t} \qquad [6]$$

Each regression in [6] has i=1,...,$N_t$ observations (where $N_t$ is the number of credit unions live in year t). The focus is on the cross-sectional size-growth relationship, which might be either positive ($\beta_{1,t}$>0), neutral ($\beta_{1,t}$=0) or negative ($\beta_{1,t}$<0). The nature of this relationship is permitted to vary over time. The case $\beta_{1,t}$=0 represents Gibrat's Law, interpreted as a descriptor of the cross-sectional size-growth relationship.

In order to focus solely on growth that is internally generated, rather than growth that is achieved by means of M&A, the lagged size and lagged growth covariates in [6] of any credit union that was an acquirer are adjusted by defining the lagged values for a 'synthetic' credit union constructed using the aggregate assets of the acquirer and the acquired credit union as separate entities at the relevant data-points.[14] The cross-sectional size-growth regressions are estimated using the Heckman (1979) sample-selection model, to mitigate potential survivorship bias.[15] The latter might arise because the probability that a credit union survives, and therefore appears in the data set for the estimation of the growth regression, might be related to the credit union's propensity for growth. The direction of any association between growth and survival might be either positive or negative: on the one hand, reckless growth in lending might increase the risk of disappearance as a consequence of financial distress; but on the other hand, sluggish growth in lending might reflect operational inefficiency or underperforming management. The sample-selection model comprises [6], and the following survivorship regression observed for all credit unions live at t–1:

$$z^*_{i,t} = \gamma_{0,t} + \gamma_{1,t}s_{i,t-1} + \gamma_{2,t}(s_{i,t-1} - s_{i,t-2}) + \gamma_{3,t}'x_{i,t-1}$$

$z_{i,t} = 1$ if $z^*_{i,t} + \varepsilon_{i,t} > 0$; $\quad$ $z_{i,t} = 0$ if $z^*_{i,t} + \varepsilon_{i,t} < 0$ [7]

where $\gamma_{3,t}$ is a vector of coefficients, and $x_{i,t-1} = (s_{i,t-1} \; s_{i,t-1}-s_{i,t-2} \; K_{i,t-1} \; Q_{i,t-1} \; L_{i,t-1} \; N_{i,t-1} \; E_{i,t-1} \; R_{i,t-1})$. See section III for covariate definitions. Equation [6] is observed only for those credit unions that were live at t–1 and survived to t, for which $z_{i,t} = 1$ in [7]. The disturbances $u_{i,t}$ in [6] and $\varepsilon_{i,t}$ in [7] are assumed to be bivariate normal, with $\text{var}(\varepsilon_{i,t}) = 1$, $\text{var}(u_{i,t}) = \sigma^2_{u,t}$, $\text{corr}(\varepsilon_{i,t}, u_{i,t}) = \rho_{\varepsilon u,t}$. The covariates that appear in the survivorship regression are the same as those in the acquisition and failure hazard functions reported in section 2, with the sole exception of the age covariate, which was generally insignificant in preliminary estimations of the sample-selection model.

Estimation Results: Time-Series Regressions

Table 7 reports summary results from Augmented Dickey-Fuller (ADF) unit root tests on the log assets series (Dickey and Fuller, 1979), together with the associated Im, Pesaran and Shin (2003) (IPS) panel unit root tests, based on estimations of [5] for each of the 7,247 surviving credit unions that reported assets data in every December call report from 1994 to 2010 (inclusive). The summary results for the ADF tests are the proportions of rejections of the unit root null hypothesis ($\alpha_{1,i}$=0 in [5]) in favour of the stationarity alternative ($\alpha_{1,i}$<0) at the 0.01, 0.05 and 0.1 significance levels. These proportions are reported for the full cohort of 7,247 surviving credit unions, and for the same cohort subdivided by rank based on December 1994 assets as follows: size band (i) comprises rank 1-250; (ii) 251-500; (iii) 500-1000; (iv) 1001-2000; (v) 2001-7247 (rank 1 denotes the largest credit union in December 1994). Akaike Information Criterion (AIC) is used to determine $m_i$, the lag-length for the first-difference terms in log assets on the right-hand-side of [5], for each credit union individually. The IPS procedure tests the null hypothesis of a unit root for all panel constituents ($\alpha_{1,i}$=0 for all i in [5]) against the alternative of stationarity for one or more panel constituents ($\alpha_{1,i}$<0 for some i).

According to Table 7, the proportions of rejections of the unit root null hypothesis in the ADF tests are higher than the proportions that should be expected due to Type 1 error (equivalent to the significance level) if the null hypothesis were true in every case. For example, the proportion of rejections at the 0.05 level for the entire cohort of surviving credit unions is 0.153. The IPS test rejects decisively the null hypothesis of a unit root for every credit union, with a p-value of 0.000. Across size bands (i)-(v), however, there is some variation in this pattern. At the 0.05 level the propensity for the ADF test to reject the unit root null hypothesis is lowest for the largest December 1994 asset size band (i). This propensity increases (and is therefore inversely related to asset size) over bands (i) to (iii). Between bands (iii) to (v) there is little or no relationship between size and the propensity for the ADF test to reject. A similar pattern is obtained from the IPS test, which fails to reject the null for bands (i) and (ii). For band (iii) the result of the IPS test is borderline, with a p-value of 0.0379. For bands (iv) and (v) the null is rejected decisively.[16]

Overall, the time-series estimations indicate that Gibrat's Law, interpreted as a descriptor of the dynamics of the size-growth relationship for each credit union individually, cannot be rejected for surviving credit unions at the upper end of the asset size distribution. For smaller credit unions the pattern is mixed. Gibrat's Law is rejected as a descriptor of the dynamics of the size-growth relationship for all of the smaller credit unions: in some cases log assets is stationary in relation to a deterministic time trend. At the 0.05 level, the percentage rejection rate of the unit root null among the smaller credit unions is slightly below 16% in the ADF tests. With a maximum sample size of T=17, however, the ADF test has limited power, suggesting that the true proportion of smaller credit unions departing from Gibrat's Law might be substantially larger than the ADF test rejection rates indicate.

Estimation Results: Cross-Sectional Regressions

Table 8 reports the estimation results for the cross-sectional sample-selection model of survivorship and growth. A separate set of equations is reported for growth rates defined over yearly intervals (ending in December) for the period 1996 to 2010 inclusive. The survivorship regressions include the same set of covariates as the hazard functions reported in Section IV with the exception of the age covariate, for which the coefficients were small and insignificant in preliminary estimations of the survivorship regressions. A lagged growth covariate is included in the cross-sectional survivorship regressions. The latter, which are dominated by disappearances owing to M&A, are similar to the M&A hazard function reported in Table 5, with a reversal of signs on all coefficients because survival, rather than disappearance, is coded one, and disappearance coded zero.

The coefficients on the size, lagged growth, capitalization and return on assets covariates are predominantly positive and significant. The coefficients on the liquidity covariate are predominantly negative, and several are significant. These coefficients may be interpreted in the same way as the corresponding coefficients in the hazard function estimations reported in section III. The coefficients on the loans-to-assets covariate are predominantly positive and several are significant prior to the late-2000s financial crisis; but several negative coefficients are obtained from t=2007 onwards. The change in sign might be linked to the fact that a significant share (around 50% on average) of a credit union's loan book takes the form of 'first mortgage real estate' and 'other real estate'. This aspect of the loan book came under significant pressure during the financial crisis of the late-2000s, when a low loans-to-assets ratio may have increased the probability of survival. The coefficients on the non-performing loans covariate are varied in sign, but predominantly insignificant. The coefficients on the non-interest expenses covariates are predominantly negative and significant.

The estimates of the correlation coefficient between the stochastic components of the survivorship and growth regressions are varied in sign, but negative and significant in the estimations that correspond to the economic downturns of the early- and late-2000s. A plausible interpretation is that rapid expansion of a financial-service provider's balance sheet correlates negatively with survival during a downturn.

In the growth regressions, the coefficients on the lagged asset size covariate are all positive and significant; and the coefficients on the lagged growth covariate are likewise positive and significant. These results are indicative of a pattern of divergence in the size distribution, with the larger institutions growing faster on average than their smaller counterparts. In the cross-sectional dimension, accordingly, Gibrat's Law is unequivocally rejected. A pattern of positive persistence in growth has tended to increase the pace of divergence.

Differences in product and service mix, product delivery mechanisms and operational characteristics of large and small credit unions can help explain the pattern of divergence in growth. For example, at the end of 2010 unsecured lending for large credit unions (assets greater than $500 million) accounted for 10.8% of all loans; the corresponding figure for small credit unions (assets less than $10 million assets) was 21.1%. The average loan size was $14,173 for large credit unions, and $5,624 for small credit unions. 84.2% of large credit unions provided business loans, while only 7.0% of small credit unions did so. Technological capability in service delivery was size-dependent: 100% of large credit unions provided web-based home banking, while only 48% of small credit unions did so. Large credit unions used 0.26 full-time equivalent employees per million of assets; the corresponding figure for small credit unions was 0.45.

## V. CONCLUSION

This study examines the impact of exit and internally-generated growth on the firm-size distribution of the US credit union sector for the period 1994-2010. This period represents the most recent stage of a longer-term phase of consolidation that has seen the number of credit unions reduced from a peak of 23,866 in 1969 to 7,334 in 2010.

The econometric analysis reported in this study comprises a panel estimation of hazard functions for the determinants of exit through acquisition or failure, and two sets of time-series and cross-sectional regressions for the relationship between asset size and internally-generated growth. The cross-sectional estimations include a control for survivorship bias. The empirical hazard functions indicate that smaller credit unions are at greater risk than larger ones of disappearance through either acquisition or failure. After controlling for asset size older credit unions are at higher risk of acquisition, but the failure probability is not age-dependent. The empirical relationship between capitalization and the probability of acquisition is negative as anticipated, but highly capitalized credit unions appear to be at higher risk of failure. This latter pattern might be driven by a size effect (smaller institutions are more highly capitalized on average, and at higher risk of failure); or it might reflect balance-sheet adjustments on the part of distressed credit unions shortly prior to liquidation. Credit unions holding a high proportion of their assets in liquid form, and credit unions with low loans-to assets ratios, are at higher risk of exit through acquisition or failure. While consolidation through M&A has had a large impact on the size of the credit union population, the impact of consolidation on concentration is modest, owing to the majority of the acquired credit unions having been small in terms of asset size.

Consistent with the trend in the population size distribution and concentration revealed in descriptive tabulations, the growth regressions are indicative of a pattern of divergence in the population size distribution that is highly consistent over time, with the larger institutions having grown faster, on average, than their smaller counterparts. Interpreted as a descriptor of the dynamics of the size-growth relationship for each credit union individually, Gibrat's Law accurately describes the growth of credit unions at the upper end of the asset size distribution, but is rejected in favour of a stationary alternative for many smaller credit unions. Interpreted as a descriptor of the cross-sectional size-growth relationship, Gibrat's Law is unequivocally rejected. The inclusion of a control for survivorship bias in the cross-sectional growth regressions suggests that rapid expansion of a credit union's balance sheet correlates negatively with survival during an economic downturn. Divergence in the average rate of internally-generated growth between the smaller and larger institutions is identified as the principal factor driving the observed increase in concentration.

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## ENDNOTES

[1] According to the World Bank Financial Structure database (2010), the five-firm concentration ratio ($CR_5$) for the US banking industry was 21% in 2003 and 37% in 2009; for the UK: 86% (1993) and 88% (2009); for France: 46% (1993) and 52% (2009); for Germany: 50% (1993) and 77% (2009); and for Japan: 30% (1993) and 65% (2009).

[2] According to Sutton (1997) Caves (1998) and Coad (2009), Gibrat's Law provides an accurate representation of the actual size distribution of firms in many industries. Empirical tests of Gibrat's Law have produced mixed results. A number of early studies, based on data up to and including the 1970s, report either no relationship or a positive relationship between firm size and growth. Several recent studies find a consistent tendency for small firms to grow faster than large firms.

[3] Worldwide, more than 50,000 credit unions operate in 100 countries, with a combined membership of 188 million and assets under control of $1,460bn (World Council of Credit Unions, 2011). The credit union operating and business model is relatively homogeneous across countries. The US credit union movement is among the most developed in the world, and the US experience offers insights for cooperative movements in financial services worldwide.

[4] During the 1990s and 2000s financial deregulation also eased many of the constraints on the business activities of US banks, increasing competition as barriers to entry into local or state banking markets were reduced or eliminated. An increasingly dominant group of large banks, operating a high-volume low-cost retail banking model, pursued aggressive growth strategies, including M&A on a large scale. Although similar trends towards deregulation and consolidation have been operative for banks and credit unions alike, analogies should be drawn cautiously in view of the difference between the profit and non-profit orientation of the two types of institution.

[5] Neither banks nor credit unions face restrictions on the prices they charge for specific products. Credit unions, however, face some restrictions on their volumes of small-business lending, while banks are subject to limits on lending concentration.

[6] Several studies examine the impact of credit union M&A on financial performance (Fried et al., 1999; Ralston et al., 2001; Bauer et al., 2009; Mcalevey et al., 2010; Wilcox and Dopico, 2011).

[7] With the exception of some securities investments, credit unions were originally distinguished from other financial institutions by their emphasis on small value, unsecured, non-mortgage loans to individuals and households. Federal credit unions gained the authority to make long-term (up to 30 years) mortgage real estate loans in 1977. At the end of 2010, first mortgages accounted for 39.3% of all loans, and second mortgages accounted for 7.6%. The 1994 figures were 21.3% and 5.5%, respectively. Other changes to the typical product mix of credit unions include growth in the importance of credit-card lending. Around 53% of credit unions offered credit cards in 2010 (CUNA, 2010). Unsecured lending accounted for only 10.8% of all credit union lending in 2010, down from 20.3% in 1994.

[8] For discussion of the background to CUMAA, see Frame et al. (2002). CUMAA also introduced a capital regulation system of net worth requirements and prompt corrective action, which came into force in 2000. Congressional hearings were held in 2005 to examine the tax-exempt status of credit unions, justified by its proponents as a policy tool to tackle financial exclusion. Tax-reform proponents argue that credit unions should be subject to corporate taxation (US Government Accountability Office, 2005). Following the 2005 hearings the tax-exempt status of credit unions was retained, despite intense lobbying by banks for its abolition.

[9] Corporate credit unions provide services for (retail) credit unions, including deposit of excess funds, payment services and access to liquid funds if required.

[10] In addition the NCUA has approved a new rule requiring credit union directors to receive financial literacy training, and opened a new office of Consumer Protection.

[11] An analysis of churning in the rankings of US credit unions at the top end of the asset size distribution also reflects a high level of stability in the size distribution. The same two credit unions, Navy Federal and State Employees, occupied the top two positions throughout this period; and seven of the ten largest credit unions in December 1995 also featured among the ten largest in December 2010.

[12] The CUMAA specifies mandatory actions for credit unions that do not meet capital adequacy standards. These include: annual earnings retentions of at least 0.4% of total assets; the submission and adherence to a net worth restoration plan (NWRP); lending restrictions; and the prohibition of increases in assets until net worth is restored. The CUMAA allows the NCUA to use 14 supervisory actions to supplement the mandatory actions.

[13] The case $\alpha_{1,i}>0$, in which growth tends to increase with size, is usually disregarded because it implies unstable or explosive growth. The possibility that large firms tend to grow more rapidly than small firms can accommodated, however, through suitable variation over i in the trend coefficients $\alpha_{3,i}$ (in the case $\alpha_{1,i}<0$, where log size is stationary relative to a deterministic time trend), or the drift coefficients $\alpha_{0,i}$ (in the case $\alpha_{1,i}=\alpha_{3,i}=0$, where log size is non-stationary).

[14] For the observation following an acquisition that took place between t–1 and t, the acquirer's 'synthetic' growth rate is $s_{i,t}-s^*_{i,t-1}$, where $s^*_{i,t-1}$ is the logarithm of the sum of the assets of the acquirer and the acquired as separate entities at t–1, and the lagged 'synthetic' growth is $s^*_{i,t-1}-s^*_{i,t-2}$, with $s^*_{i,t-2}$ defined in the same manner at t–2. Where the acquisition took place between t–1 and t–2, the lagged 'synthetic' growth is $s_{i,t-1}-s^*_{i,t-2}$.

[15] An inverse empirical size-growth relationship may be a manifestation of survivorship bias. Small firms are less likely to survive than large firms, but fast-growing small firms are likelier to survive than slow-growing ones. As a consequence, studies using samples of firms that survive over the entire period of the analysis are subject to a form of survivorship bias, because firms that failed to achieve rapid growth and exited would not have been recorded.

[16] The power of the IPS test is dependent on the number of panel constituents. However, the observed pattern of rejection and non-rejection is not a feature of variation in the power of this test. A similar pattern is obtained if the cohort is subdivided into equal-sized quintiles based on June 1994 assets (with each quintile containing either 1,449 or 1,450 credit unions). The IPS test fails to reject the null for the largest assets-size quintile (p-value=.7447); but the IPS test rejects the null for each of the four smaller size quintiles (p-value=.0000 in each case).

## TABLES

**TABLE 1**
**Trends in the size distribution of the population of US credit unions, 1994-2010, and projections, 2011-2015**

| | Number of credit unions by asset size class | | | | | Total |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | number |
| Panel A: Actual | | | | | | |
| Dec 94 | 3805 | 2919 | 2586 | 1657 | 1085 | 12052 |
| Dec 95 | 3648 | 2812 | 2506 | 1661 | 1120 | 11747 |
| Dec 96 | 3429 | 2715 | 2473 | 1656 | 1170 | 11443 |
| Dec 97 | 3275 | 2638 | 2442 | 1669 | 1222 | 11246 |
| Dec 98 | 3047 | 2522 | 2438 | 1690 | 1295 | 10992 |
| Dec 99 | 2784 | 2415 | 2395 | 1705 | 1329 | 10628 |
| Dec 00 | 2659 | 2314 | 2300 | 1700 | 1342 | 10315 |
| Dec 01 | 2370 | 2111 | 2317 | 1731 | 1454 | 9983 |
| Dec 02 | 2147 | 1955 | 2305 | 1738 | 1542 | 9687 |
| Dec 03 | 1938 | 1832 | 2256 | 1764 | 1578 | 9368 |
| Dec 04 | 1788 | 1777 | 2143 | 1713 | 1594 | 9015 |
| Dec 05 | 1732 | 1705 | 2061 | 1614 | 1580 | 8692 |
| Dec 06 | 1671 | 1656 | 1919 | 1570 | 1544 | 8360 |
| Dec 07 | 1602 | 1584 | 1850 | 1516 | 1545 | 8097 |
| Dec 08 | 1458 | 1475 | 1801 | 1503 | 1563 | 7800 |
| Dec 09 | 1308 | 1351 | 1729 | 1494 | 1666 | 7548 |
| Dec 10 | 1221 | 1281 | 1707 | 1466 | 1660 | 7335 |
| Panel B: Projected | | | | | | |
| Dec 11 | 1141 | 1216 | 1683 | 1436 | 1653 | 7132 |
| Dec 12 | 1066 | 1154 | 1657 | 1413 | 1646 | 6938 |
| Dec 13 | 997 | 1097 | 1630 | 1388 | 1639 | 6752 |
| Dec 14 | 933 | 1044 | 1602 | 1364 | 1631 | 6574 |
| Dec 15 | 874 | 993 | 1574 | 1341 | 1623 | 6404 |

Note: Asset size classes are defined in real terms, measured in 1994 prices, as follows. class 1, assets below $2m; class 2, assets between $2m and $6m; class 3, assets between $6m and $18m; class 4, assets between $18m and $54m; class 5, assets above $54m. All price conversions are based on the US GDP deflator.

**TABLE 2**
**Yearly rates of transition between asset size classes, 1994-2010**

| Size class, t | Size class, t+1 | Year, t | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
| | 2 | .911 | .916 | .922 | .908 | .914 | .909 | .854 | .869 | .886 | .906 | .875 | .883 | .905 | .886 | .868 | .899 |
| | 3 | .026 | .035 | .039 | .058 | .043 | .022 | .106 | .085 | .054 | .020 | .014 | .014 | .023 | .046 | .091 | .038 |
| 1 | 1 | .922 | .915 | .934 | .917 | .898 | .919 | .881 | .890 | .883 | .893 | .902 | .902 | .922 | .893 | .884 | .910 |
| | 2 | .016 | .024 | .025 | .033 | .022 | .014 | .046 | .041 | .038 | .016 | .010 | .010 | .010 | .023 | .037 | .023 |
| | Exit | .062 | .061 | .041 | .050 | .081 | .067 | .073 | .070 | .079 | .091 | .088 | .088 | .069 | .083 | .079 | .067 |
| 2 | 1 | .043 | .026 | .021 | .014 | .015 | .036 | .008 | .015 | .015 | .030 | .064 | .059 | .035 | .016 | .010 | .019 |
| | 2 | .911 | .916 | .922 | .908 | .914 | .909 | .854 | .869 | .886 | .906 | .875 | .883 | .905 | .886 | .868 | .899 |
| | 3 | .026 | .035 | .039 | .058 | .043 | .022 | .106 | .085 | .054 | .020 | .014 | .014 | .023 | .046 | .091 | .038 |
| | Exit | .020 | .023 | .018 | .019 | .029 | .032 | .032 | .031 | .045 | .044 | .048 | .045 | .037 | .051 | .031 | .042 |
| 3 | 2 | .035 | .020 | .020 | .009 | .018 | .033 | .005 | .011 | .007 | .039 | .062 | .065 | .036 | .018 | .009 | .021 |
| | 3 | .924 | .940 | .937 | .931 | .930 | .922 | .899 | .914 | .927 | .917 | .899 | .891 | .919 | .919 | .881 | .937 |
| | 4 | .033 | .029 | .036 | .050 | .037 | .025 | .079 | .055 | .047 | .018 | .014 | .012 | .020 | .039 | .084 | .027 |
| | Exit | .007 | .011 | .007 | .011 | .014 | .020 | .017 | .021 | .019 | .027 | .026 | .032 | .025 | .023 | .026 | .016 |
| 4 | 3 | .024 | .011 | .010 | .005 | .011 | .021 | .003 | .005 | .007 | .022 | .065 | .036 | .031 | .016 | .006 | .023 |
| | 4 | .947 | .952 | .952 | .936 | .951 | .955 | .911 | .930 | .949 | .940 | .905 | .932 | .929 | .933 | .888 | .934 |
| | 5 | .026 | .033 | .034 | .051 | .031 | .018 | .074 | .054 | .031 | .024 | .018 | .017 | .023 | .030 | .083 | .024 |
| | Exit | .004 | .004 | .004 | .008 | .007 | .006 | .012 | .011 | .012 | .013 | .013 | .014 | .018 | .020 | .023 | .019 |
| 5 | 4 | .006 | .003 | .004 | .004 | .006 | .009 | .001 | .001 | .003 | .008 | .021 | .025 | .013 | .009 | .004 | .014 |
| | 5 | .993 | .995 | .995 | .989 | .985 | .987 | .990 | .994 | .988 | .983 | .972 | .959 | .977 | .981 | .985 | .975 |
| | Exit | .002 | .003 | .001 | .007 | .008 | .003 | .010 | .004 | .008 | .009 | .006 | .016 | .010 | .010 | .010 | .011 |

Note: Asset size classes are defined in real terms, measured in 1994 prices, as follows. class 1, assets below $2m; class 2, assets between $2m and $6m; class 3, assets between $6m and $18m; class 4, assets between $18m and $54m; class 5, assets above $54m. All price conversions are based on the US GDP deflator.

**TABLE 3**
**Entrants and exits, 1995-2010**

| | Entrants | Acquisition | Purchase & Assumption | Liquidation | Conversion to bank | Conversion to privately insured | Unclassified disappearance | Total exits | Exit rate | Number live at end of year |
|---|---|---|---|---|---|---|---|---|---|---|
| 1994 | - | - | - | - | - | - | - | - | - | 12052 |
| 1995 | 13 | 290 | 5 | 22 | 1 | 0 | 0 | 318 | .0264 | 11747 |
| 1996 | 20 | 293 | 11 | 17 | 1 | 1 | 1 | 324 | .0276 | 11443 |
| 1997 | 19 | 192 | 4 | 17 | 0 | 3 | 0 | 216 | .0189 | 11246 |
| 1998 | 8 | 215 | 5 | 28 | 3 | 11 | 0 | 262 | .0233 | 10992 |
| 1999 | 13 | 335 | 11 | 24 | 3 | 4 | 0 | 377 | .0343 | 10628 |
| 2000 | 13 | 292 | 13 | 18 | 3 | 0 | 0 | 326 | .0307 | 10315 |
| 2001 | 10 | 296 | 8 | 25 | 6 | 2 | 5 | 342 | .0332 | 9983 |
| 2002 | 7 | 265 | 7 | 23 | 1 | 4 | 3 | 303 | .0304 | 9687 |
| 2003 | 15 | 315 | 5 | 10 | 2 | 2 | 0 | 334 | .0345 | 9368 |
| 2004 | 3 | 332 | 6 | 11 | 3 | 0 | 4 | 356 | .0380 | 9015 |
| 2005 | 8 | 302 | 1 | 25 | 2 | 0 | 1 | 331 | .0367 | 8692 |
| 2006 | 10 | 313 | 2 | 23 | 1 | 0 | 3 | 342 | .0394 | 8360 |
| 2007 | 4 | 248 | 2 | 10 | 3 | 0 | 4 | 267 | .0319 | 8097 |
| 2008 | 4 | 275 | 1 | 19 | 1 | 1 | 4 | 301 | .0372 | 7800 |
| 2009 | 4 | 229 | 1 | 23 | 1 | 2 | 0 | 256 | .0328 | 7548 |
| 2010 | 5 | 190 | 7 | 19 | 0 | 0 | 2 | 218 | .0289 | 7335 |

**TABLE 4**
**Descriptive statistics: Mean values of key variables, by year**

| | $S_{i,t}$ | $A_{i,t}$ | $K_{i,t}$ | $Q_{i,t}$ | $L_{i,t}$ | $N_{i,t}$ | $E_{i,t}$ | $R_{i,t}$ |
|---|---|---|---|---|---|---|---|---|
| Dec 94 | 24.22 | 38.82 | .127 | .0384 | .615 | .00432 | .0200 | .0199 |
| Dec 95 | 26.29 | 39.86 | .134 | .0403 | .643 | .00436 | .0208 | .0217 |
| Dec 96 | 28.71 | 40.91 | .140 | .0377 | .651 | .00430 | .0216 | .0211 |
| Dec 97 | 31.32 | 41.88 | .145 | .0380 | .651 | .00426 | .0223 | .0206 |
| Dec 98 | 35.42 | 42.90 | .145 | .0397 | .617 | .00429 | .0218 | .0193 |
| Dec 99 | 38.78 | 43.96 | .148 | .0994 | .625 | .00397 | .0179 | -.0113 |
| Dec 00 | 42.55 | 44.97 | .145 | .1095 | .662 | .00387 | .0201 | .0039 |
| Dec 01 | 50.32 | 46.00 | .138 | .1573 | .600 | .00411 | .0192 | .0022 |
| Dec 02 | 57.91 | 47.03 | .135 | .1560 | .570 | .00419 | .0188 | .0033 |
| Dec 03 | 65.55 | 48.03 | .133 | .1631 | .553 | .00408 | .0187 | .0021 |
| Dec 04 | 72.26 | 49.08 | .136 | .1410 | .564 | .00385 | .0190 | .0020 |
| Dec 05 | 78.61 | 50.20 | .143 | .1209 | .595 | .00389 | .0198 | .0021 |
| Dec 06 | 85.53 | 51.21 | .151 | .1200 | .618 | .00310 | .0208 | .0023 |
| Dec 07 | 93.64 | 52.23 | .155 | .1287 | .613 | .00314 | .0213 | .0021 |
| Dec 08 | 104.3 | 53.36 | .151 | .1251 | .586 | .00364 | .0208 | -.0004 |
| Dec 09 | 117.2 | 54.43 | .138 | .1410 | .552 | .00388 | .0199 | -.0025 |
| Dec 10 | 124.6 | 55.50 | .134 | .1471 | .530 | .00402 | .0216 | -.0002 |

Note: Variable definitions are as follows: $S_{i,t}$ = Total Assets; $A_{i,t}$ = Age; $K_{i,t}$ = capital-to-assets ratio = Net Worth /Total Assets; $Q_{i,t}$ = Liquid Assets / Total Assets; $L_{i,t}$ = Loans / Total Assets; $N_{i,t}$ = Non-performing loans / Total Assets; $E_{i,t}$ = Non-interest Expenses / Total Assets; $R_{i,\,t}$ = return on assets = Net Income / Total Assets

**TABLE 5**
**Estimation results: M&A and failure hazard functions**

| | M&A hazard | Failure hazard |
|---|---|---|
| $s_{i,t-1}$ | -.3892 | -.3733 |
| | (-47.5) | (-13.1) |
| $a_{i,t-1}$ | .2232 | -.0689 |
| | (6.57) | (-0.81) |
| $K_{i,t-1}$ | -3.2013 | 2.1939 |
| | (-15.8) | (6.40) |
| $Q_{i,t-1}$ | .8537 | 1.4142 |
| | (8.26) | (5.28) |
| $L_{i,t-1}$ | .1354 | -1.2614 |
| | (1.74) | (-4.32) |
| $N_{i,t-1}$ | -.5707 | 1.8707 |
| | (2.12) | (4.40) |
| $E_{i,t-1}$ | 1.3732 | -0.3604 |
| | (6.38) | (-0.83) |
| $R_{i,t-1}$ | -4.5576 | -3.5482 |
| | (-20.9) | (-5.47) |
| No. of observations | 311637 | 311637 |
| No. of disappearances | 4471 | 341 |
| log-likelihood | -39325.3 | -2652.0 |

Note: Variable definitions are as follows: $s_{i,t-1}$ = logarithm of Total Assets at the six-monthly data-point prior to disappearance; $a_{i,\,t-1}$ = log Age; $K_{i,\,t-1}$ = capital-to-assets ratio = Net Worth /Total Assets; $Q_{i,\,t-1}$ = Liquid Assets / Total Assets; $L_{i,\,t-1}$ = Loans / Total Assets; $N_{i,\,t-1}$ = Non-performing loans / Total Assets; $E_{i,\,t-1}$ = Non-interest Expenses / Total Assets; $R_{i,\,t-1}$ = return on assets = Net Income / Total Assets

**TABLE 6**
**Trends in industry concentration measures, 1994-2010**

| | Concentration ratios | | | Actual | | Counterfactual (no M&A) | |
|---|---|---|---|---|---|---|---|
| | $CR_5$ | $CR_{10}$ | $CR_{20}$ | HHI | Numbers equivalent | HHI | Numbers equivalent |
| Dec 94 | 6.2 | 8.8 | 12.2 | 19.2 | 520.9 | 19.2 | 521.8 |
| Dec 95 | 6.1 | 8.8 | 12.4 | 19.2 | 520.3 | 19.1 | 523.9 |
| Dec 96 | 6.1 | 8.8 | 12.5 | 19.0 | 525.9 | 18.8 | 530.9 |
| Dec 97 | 6.3 | 8.9 | 12.8 | 19.7 | 506.6 | 19.5 | 513.1 |
| Dec 98 | 6.5 | 9.2 | 13.2 | 20.5 | 486.8 | 20.2 | 494.3 |
| Dec 99 | 6.5 | 9.4 | 13.4 | 20.8 | 480.9 | 20.4 | 489.8 |
| Dec 00 | 6.7 | 9.6 | 13.8 | 21.9 | 457.3 | 21.4 | 467.2 |
| Dec 01 | 7.0 | 10.2 | 14.4 | 23.9 | 418.5 | 23.4 | 428.2 |
| Dec 02 | 7.4 | 10.7 | 15.0 | 25.8 | 388.2 | 25.1 | 397.9 |
| Dec 03 | 7.6 | 10.9 | 15.2 | 27.1 | 368.3 | 26.4 | 378.8 |
| Dec 04 | 8.1 | 11.4 | 15.8 | 29.7 | 337.1 | 28.8 | 347.3 |
| Dec 05 | 8.5 | 11.9 | 16.5 | 31.4 | 318.2 | 30.4 | 328.7 |
| Dec 06 | 9.0 | 12.4 | 17.3 | 34.3 | 291.9 | 32.9 | 303.7 |
| Dec 07 | 9.9 | 13.3 | 18.4 | 40.1 | 249.5 | 38.5 | 259.7 |
| Dec 08 | 10.1 | 13.7 | 18.8 | 41.9 | 238.6 | 40.2 | 248.7 |
| Dec 09 | 10.2 | 13.6 | 18.4 | 42.2 | 237.1 | 40.3 | 248.0 |
| Dec 10 | 10.8 | 14.3 | 19.1 | 46.5 | 215.2 | 43.8 | 228.5 |

**TABLE 7**
**Estimation results: Time-series growth regressions**

| | Rank by December 1994 assets size | | | | | All |
|---|---|---|---|---|---|---|
| | 1-250 | 251-500 | 501-1000 | 1001-2000 | 2001-7247 | |
| ADF tests: proportion of rejections of the unit root null hypothesis | | | | | | |
| $\alpha$=0.01 | .040 | .060 | .080 | .063 | .075 | .072 |
| $\alpha$=0.05 | .108 | .116 | .156 | .144 | .159 | .153 |
| $\alpha$=0.1 | .196 | .172 | .220 | .218 | .230 | .225 |
| IPS panel unit root test | | | | | | |
| $Z_{tbar}$ | 5.35 | 2.26 | -1.775 | -4.883 | -18.005 | -16.185 |
| p-value | 1.0000 | .9881 | .0379 | .0000 | .0000 | .0000 |

**TABLE 8**
**Estimation results: Cross-sectional survivorship and growth regressions**

| t | Growth regression dep. var. = $(s_{i,t}–s_{i,t–1})$ | | | Survivorship regression dep. var. = 1 for credit unions that survived from t–1 to t, 0 for credit unions that disappeared | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $s_{t–1}$ | $s_{i,t–1}–s_{i,t–2}$ | const. | $s_{i,t–1}$ | $s_{i,t–1}–s_{i,t–2}$ | $K_{i,t–1}$ | $Q_{i,t–1}$ | $L_{i,t–1}$ | $N_{i,t–1}$ | $E_{i,t–1}$ | $R_{i,t–1}$ | const. | atanh($\rho_{\varepsilon u}$) |
| 1996 | .006*** | .253*** | -.060*** | .195*** | 1.71*** | 1.27*** | -.272 | .421** | 3.58* | -7.10*** | -.746 | -1.01*** | .031 |
| | (12.0) | (29.4) | (-8.17) | (10.2) | (7.59) | (3.18) | (-0.66) | (2.55) | (1.78) | (-3.82) | (-0.35) | (-3.09) | (1.13) |
| 1997 | .009*** | .282*** | -.125*** | .133*** | 2.26*** | -.109 | -.516 | .187 | 1.09 | -5.32** | 4.18 | .129 | -.008 |
| | (17.9) | (27.4) | (-15.1) | (6.08) | (7.47) | (-0.26) | (-1.03) | (0.90) | (0.55) | (-2.33) | (1.50) | (0.34) | (-0.18) |
| 1998 | .011*** | .256*** | -.113*** | .131*** | 1.56*** | .139 | -.502 | .229 | -.911 | -4.74** | 4.63* | -.025 | .022 |
| | (21.5) | (29.3) | (-14.7) | (6.54) | (5.95) | (0.35) | (-1.10) | (1.19) | (-0.40) | (-2.31) | (1.86) | (-0.07) | (0.72) |
| 1999 | .002*** | .243*** | -.013* | .144*** | 2.59*** | 1.15*** | -1.58*** | .549*** | .674 | -5.00** | 5.04** | -.769** | -.047 |
| | (4.38) | (24.2) | (-1.66) | (7.89) | (9.53) | (3.31) | (-4.10) | (3.13) | (0.32) | (-2.52) | (2.12) | (-2.46) | (-1.11) |
| 2000 | .011*** | .120*** | -.155*** | .191*** | 2.65*** | 1.88*** | .085 | .176 | -2.29 | -5.89*** | 5.29*** | -1.20*** | -.033 |
| | (19.2) | (12.3) | (-17.4) | (10.1) | (9.48) | (5.05) | (0.40) | (1.14) | (-1.32) | (-4.09) | (8.80) | (-3.94) | (-0.39) |
| 2001 | .011*** | .164*** | -.079*** | .129*** | 1.34*** | .587 | -.420** | .529*** | -2.16 | -9.74*** | 8.58*** | -.122 | -.097** |
| | (20.5) | (15.7) | (-9.20) | (7.13) | (6.46) | (1.57) | (-2.12) | (3.46) | (-0.98) | (-6.35) | (6.34) | (-0.38) | (-2.25) |
| 2002 | .004*** | .236*** | -.025*** | .106*** | 2.47*** | 1.52*** | -.514*** | .130 | 12.8*** | -2.47 | 19.48*** | -.098 | -.253*** |
| | (8.38) | (24.2) | (-2.96) | (5.20) | (8.31) | (3.45) | (-2.70) | (0.73) | (4.52) | (-1.32) | (10.0) | (-0.28) | (-5.26) |
| 2003 | .008*** | .295*** | -.091*** | .114*** | 1.76*** | 1.18*** | -.322* | .791*** | -2.86 | -5.39*** | 10.65*** | -.373 | -.273*** |
| | (15.1) | (29.2) | (-10.6) | (5.58) | (6.44) | (2.88) | (-1.87) | (4.51) | (-1.46) | (-3.26) | (6.53) | (-1.11) | (-3.73) |
| 2004 | .007*** | .242*** | -.117*** | .153*** | 1.06*** | 1.14*** | -.230 | .293* | -1.69 | -6.33*** | 10.80*** | -.684** | -.062 |
| | (16.0) | (25.8) | (-15.4) | (8.43) | (3.95) | (2.81) | (-1.34) | (1.81) | (-0.69) | (-4.42) | (6.97) | (-2.13) | (-1.37) |
| 2005 | .012*** | .280*** | -.203*** | .149*** | 2.16*** | 1.90*** | -.426** | .110 | 2.68 | -5.50*** | 13.14*** | -.575* | .060 |
| | (22.6) | (26.9) | (-24.1) | (7.81) | (7.11) | (4.33) | (-2.26) | (0.66) | (0.98) | (-3.56) | (7.03) | (-1.68) | (1.26) |
| 2006 | .009*** | .271*** | -.163*** | .087*** | 1.85*** | .514 | -.104 | .774*** | -.321 | -7.07*** | 10.41*** | .218 | -.070 |
| | (17.9) | (24.7) | (-18.8) | (4.74) | (6.66) | (1.32) | (-0.50) | (5.00) | (-0.12) | (-4.86) | (7.91) | (0.66) | (-1.01) |
| 2007 | .007*** | .279*** | -.108*** | .073*** | 2.43*** | .355 | -.190 | -.217 | -9.74*** | -4.38*** | 15.88*** | 1.08*** | -.052 |
| | (15.7) | (26.7) | (-13.7) | (3.51) | (7.31) | (0.80) | (-0.71) | (-1.22) | (-2.94) | (-4.17) | (9.28) | (2.74) | (-1.04) |
| 2008 | .009*** | .056*** | -.095*** | .124*** | 2.14*** | 2.01*** | -.723*** | .075 | -2.81 | -1.97* | 15.57*** | -.346 | -.117*** |
| | (15.4) | (8.52) | (-10.4) | (6.22) | (6.12) | (4.56) | (-3.05) | (0.46) | (-0.86) | (-1.93) | (9.61) | (-0.94) | (-3.44) |
| 2009 | .009*** | .275*** | -.085*** | .126*** | 1.46*** | 1.51*** | -.436* | -.089 | 17.49*** | 3.26*** | 19.98*** | -.434 | -.358*** |
| | (13.0) | (21.9) | (-7.63) | (5.95) | (5.07) | (3.24) | (-1.67) | (-0.50) | (5.35) | (4.73) | (12.0) | (-1.12) | (-6.30) |
| 2010 | .001** | .146*** | -.008 | .009 | 2.37*** | 1.69*** | -.873*** | -.176 | 0.845 | .147 | 17.92*** | 1.71*** | -.692*** |
| | (2.26) | (12.1) | (-0.80) | (0.41) | (6.80) | (3.63) | (-3.48) | (-0.86) | (0.42) | (0.13) | (11.6) | (4.17) | (-13.5) |

Note: Variable definitions are as follows: $s_{i,t-1}$ = logarithm of Total Assets at the data point at the start of the two-year interval over which growth is measured; $(s_{i,t}-s_{i,t-1})$ = logarithmic growth in assets from t–1 to t; $(s_{i,t-1}-s_{i,t-2})$ = logarithmic growth in assets from t–1 to t–2; $K_{i,\, t-1}$ = capital-to-assets ratio = Net Worth /Total Assets; $Q_{i,\, t-1}$ = Liquid Assets / Total Assets; $L_{i,\, t-1}$ = Loans / Total Assets; $N_{i,\, t-1}$ = Non-performing loans / Total Assets; $E_{i,\, t-1}$ = Non-interest Expenses / Total Assets, $R_{i,\, t-1}$ = return on assets = Net Income / Total Assets