

The Growth of US Credit Unions

John A. Goddard
University of Wales, Swansea

Donal G. McKillop
The Queens University of Belfast

John O.S. Wilson
University of St Andrews

I. INTRODUCTION

Credit unions are co-operative financial institutions. As self-help democratic institutions, credit unions world-wide have demonstrated the efficacy of co-operative principles in the management of the financial affairs of millions of people.¹ Membership of a credit union is open to all within the accepted common bond of association who can make use of its services and are willing to accept the corresponding responsibilities. Credit union members enjoy equal rights to vote and participate in decisions without regard to the size of their deposits. The major strength of credit unions lies in the appeal of their philosophy and objectives to a wide range of people, who wish to achieve greater self-sufficiency in the conduct of their financial affairs.²

In the United States, deregulation since the 1970s has had a profound effect on the kinds of products and services credit unions are entitled to provide, and on their financial and operational management.³ Deregulation was accompanied by the introduction of a less restrictive interpretation of the common bond requirement for membership, which created new opportunities for growth and merger. Between 1987 and 1999 the number of credit unions declined from 15,000 to 10,858, while the number of members increased from 53 million to 76.6 million. Growth in concentration is also reflected in an increase in the median asset size of the largest 20 credit unions, from \$571 million in 1987 to \$1,920 million in 1999.⁴

The relaxation of previously restrictive common bond requirements has inevitably brought credit unions into closer competition with other financial institutions, especially retail banks. A recurring complaint from the banks is that the present tax exemptions enjoyed by credit unions amounts to a federal subsidy, and therefore confers an unfair advantage.⁵ During the 1990s a number of high-profile court cases challenged the legality of common bond dilution. New legislation was passed in 1998 maintaining the concept of the common bond, but allowing groups with different common bonds to combine to form

¹ In excess of 97 million people in 84 countries belong to a credit union. In aggregate, the assets of credit unions world-wide have recently been calculated at \$430.5 billion (World Council of Credit Unions, 1997).

² Surveys indicate that a significant proportion of credit union members are unaware that the credit union is a co-operative financial institution. For example, Lemmon (1995) argues that members call credit unions their “bank” and do business with the credit union as their “banking choice”.

³ Key regulatory changes were: the amendment to the Federal Credit Union Act in 1977; the 1978 Financial Institutions Regulatory and Interest Rate Control Act; the 1980 Depository Institutions Deregulation and Monetary Control Act; the 1981 NCUA regulations (extended 21% ceiling and permitted credit unions to make variable interest rate consumer and mortgage loans); the 1982 Garn-St. Germain Depository Institutions Act; and the 1983 NCUA regulations (expanded the definition of “family member” in the common bond requirement).

⁴ Among depository institutions, credit unions are generally the smallest. In the US their median asset value totalled \$6.7 million at the end of 1999. The corresponding figure for commercial banks was \$71 million.

⁵ Credit unions’ exemption from federal income tax dates back to the Revenue Act of 1916, which provided tax-exempt status to mutual thrift organisations and co-operatives. The US Attorney General ruled in 1917 that credit unions, which were then all state chartered, were entitled to the exemption. The first federal credit unions were

a single credit union. The 1998 legislation did not change credit unions' tax exemptions, but it did impose limits on their commercial lending.

Regulatory change (especially the 1980 Depository Institutions Deregulation and Monetary Control Act) has provided the main stimulus for growth and consolidation in the US credit union movement.⁶ The question remains, however, as to which credit unions have made and will make the best use of the opportunities for growth that have become available. The academic literature abounds with explanations as to why certain financial institutions grow and attain large scale (Berger et al, 1999). Some researchers focus upon the superior efficiency of large institutions through their access to scale and scope economies (Berger et al, 1993, 1997).⁷ The ability of incumbents to erect entry and exit barriers may also be an important determinant. Shepherd (1997) details a wide array of exogenous and endogenous types of barriers. Other structural characteristics such as industry size and growth may also be important in determining the level and change in concentration (Rose, 1987). Regulation including antitrust legislation may also be an important determinant of concentration (Neven et al, 1993, 1998).

An alternative school of thought argues that increases in industry concentration may tend to emerge over time naturally, as a result of growth that is essentially unsystematic and random. It is observed that the empirical firm size distribution in many industries can be approximated closely by various skewed distributions including the lognormal. A stochastic model in which the logarithmic size of each firm is subjected to a sequence of purely random shocks over time tends to generate a skewed distribution of this type. The hypothesis that the growth of each firm in each period is random (in other words, independent of observable characteristics of the firm including size or past growth) was first developed by Gibrat (1931), and later became known as the law of proportionate effect (LPE). According to the LPE, growth is unrelated to firm size, so large and small firms have the same probabilities of achieving any particular growth rate in any period. Over time, however, some firms are 'lucky' and tend to draw an above-average share of high growth rates, while others are 'unlucky' and tend to remain the same size or decline. Concentration can be expected to increase naturally over time. Whatever the shape of the initial size distribution, over time the distribution will tend to become skewed.

chartered in 1934 and granted tax-exempt status in 1935 under a ruling by the Internal Revenue Service.

⁶ The 1980 Depository Institutions Deregulation and Monetary Control Act classified credit unions as depository institutions, gave permanent authority for share draft accounts, set required reserves for share drafts and raised the loan rate ceiling to 15%.

⁷ Murray and White (1983) use a translog cost function to examine for scale and scope economies using cross-sectional data on large computerised British Columbia credit unions.

Tschoegl (1983) identifies three testable propositions which derive from the LPE: first, growth rates are independent of firm size; second, above or below average growth for any individual firm does not tend to persist from one period to the next; and third, the variability of growth is independent of firm size. There is extensive empirical evidence on the validity of the LPE for manufacturing in both the US and Europe. Results have been mixed. Most early studies found either no relationship or a positive relationship between size and growth (Hart and Prais, 1956; Singh and Whittington, 1968, 1975; Samuals and Chesher, 1972). More recent studies have typically found that small firms grow faster, and tend to have more variable growth rates, than large firms (Wagner, 1992; Dunne and Hughes, 1994; Hart and Oulton, 1996, 1999). Over time the models employed have become increasingly sophisticated. For example, some researchers have developed evolutionary learning models, in which younger and less experienced firms enjoy less stable growth than their older counterparts (Evans, 1987).

Only a few studies have examined the applicability of the LPE to financial institutions. Alhadeff and Alhadeff (1964) compare the growth of the largest 200 US banks between 1930 and 1960 and find that smaller banks tended to enjoy the fastest growth. Rhoades and Yeats (1974) and Yeats et al (1975) also find some evidence of differing average growth rates for different sized banks. Tschoegl (1983) investigates the relationship between size and growth for a sample of large international banks, using 1970s data. Growth was unrelated to initial size. The variability of growth declined with size. Growth in one period was not a good predictor of growth in subsequent periods. Tschoegl also finds a positive relationship between bank size and the extent of transnationality, but growth and transnationality were unrelated. More recently, Wilson and Williams (2000) investigate the relationship between size and growth for a sample of French, German, Italian and UK banks, using data covering the period 1990-96. No relationship is found between bank size and growth for France, Germany and the UK, but in Italy small banks grew faster than large banks. Large banks are found to have less variable growth rates than their smaller counterparts. This suggests that large banks may enjoy diversification advantages, which make them less susceptible to large fluctuations in growth. US credit unions have also come under scrutiny. Barron (1992) and Barron et al (1994) analyse state-chartered credit unions in New York City between 1914 and 1990. They reject the LPE, finding that larger credit unions grew more slowly than smaller ones.

Most previous studies of the LPE concentrate on the size-growth relationship, although some also control for other influences on growth such as firm age or industrial classification. In the case of credit unions, although all institutions share a common co-operative philosophy, differences are also apparent across a wide range of operational and structural characteristics. In addition to a conventional univariate analysis of the size-growth relationship, this paper develops a multivariate analysis in an

attempt to control for a variety of differences between institutions.

Controls reflecting the following characteristics are included in the multivariate model. First, credit unions may be either state chartered or federally chartered. State financial regulation offices oversee the former, while the latter are supervised by the National Credit Union Administration (NCUA). Second, credit unions differ in terms of their common bond status. Most US credit unions (around 80%) are defined by an occupational bond. Fewer are defined by an Associational (14%) or a residential (6%) bond. Relaxation of field of membership requirements has also broadened the choice of individuals desiring credit union services, whether through the creation of a new credit union or by joining an existing one.⁸ In examining growth, it is important to distinguish between credit unions based on single common bonds and those based on multiple bonds. Third, the age of a credit union (the length of time since incorporation) might be expected to have implications for its growth performance. Fourth, the size of potential membership (given the credit union's common bond) relative to actual membership may represent either an opportunity or constraints on the credit union's ability to achieve further growth. Fifth, a range of financial structure and performance indicators, such as performance measured by return on assets (profitability) or cost-income ratio (efficiency); the strength of the credit union's capital base; or its exposure to bad debts, may also have implications for its growth performance.

The majority of previous empirical studies employ a cross sectional regression of growth over some period on initial firm size, and (in some cases) a term in lagged growth to allow for persistence in growth over time and other controls. However, if data is also available in a time series format, including observations at points between the start- and end-dates used to measure size and growth in the cross sectional regression, the cross sectional approach can be criticised for failing to exploit all available information. Using Monte Carlo methods, Goddard et al (2000) find that tests of the LPE based on panel techniques generally outperform cross sectional tests. Below, in addition to conventional univariate and multivariate cross sectional analyses of the growth of credit unions, equivalent models are also estimated using panel techniques.

The rest of this paper reports univariate and multivariate analyses of the growth of US credit unions, using a data set comprising observations at six-monthly intervals over the period December 1990 to December 1999 (12.90-12.99), and based on cross sectional and panel estimations of the growth equations. The remaining sections are structured as follows. Section II develops a number of testable propositions concerning patterns of credit union growth. Section III details the econometric methodology. Section IV presents and interprets the estimation results. Section V provides a summary

and some concluding comments.

II. DETERMINANTS OF THE GROWTH OF US CREDIT UNIONS

Section II develops a number of testable propositions concerning patterns of growth on the part of US credit unions. The section begins by considering the choice of size and growth measures. Two size measures are employed in the estimations: total assets and total membership. In studies of manufacturing, services and other types of financial organisations, assets provide a commonly used size measure (Tschoegl, 1983; Vander Venet, 1999). Whether credit unions seek to maximise asset size, however, is not immediately obvious. The fact that credit union objectives are mixed, with some members joining primarily as savers while others join to obtain credit, creates potential for conflicts of interest between members (Smith, 1986; Overstreet and Rubin, 1990). Credit unions may or may not strive to achieve growth in assets. But as emphasised by Barron (1992) most credit unions prioritise the provision of consumer loans, and the bulk of their assets are in this form. Therefore previous researchers have typically used total assets as the best measure of credit union size (Smith, 1986; Ambrugey and Dacin, 1993; Barron et al, 1994). In this study total membership is also used as an alternative size measure. As before, whether or not membership enters the credit union's objective function is open to debate, and the discussion can again be couched in terms of the saver-borrower conflict. Comparisons between the results obtained using the alternative assets and membership size measures, however, should throw some light on the nature of the growth process. The growth equations using the two measures should differ, for example, if institutions differ by size in the extent to which growth is achieved mainly by encouraging existing members to deposit larger amounts, or mainly by attracting new members.⁹

When credit unions at the two ends of the size spectrum are compared, significant differences between their typical product portfolios can be identified. Barron (1992) argues that size differences

⁸ Amburgey and Dacin (1993) suggest that the latter is becoming increasingly popular.

⁹ It should also be noted that input based credit union size measures such as employee numbers or capital expenditure would not be appropriate. While large credit unions are faced with the need to hire staff and rent or lease premises to cover their business volume, small credit unions can often cover these obligations with volunteer staff and free access to community premises. Furthermore, since smaller credit unions are more likely to have been recently formed, it is likely that they can more easily obtain grants and subsidies from charities and government agencies. According to *Credit Union Service Profile 1997*, 46% of all credit unions receive free office space. Wolken and Navaratil (1984) found that 6% of credit union operating expense is covered by sponsor subsidies. The implication is that true operating costs will exceed actual costs to a greater extent for small credit unions than for large ones.

are reflected in large differences in organisational structure and strategy. For example all credit unions, irrespective of size, offer secured and unsecured personal loans, and most also provide automobile loans. But when new product areas are examined a more fragmented picture emerges. During the 1980s and 1990s increasing numbers of credit unions started to offer real estate mortgages. In 1980 only 5% of credit unions' assets were held in this form; by the end of 1999 the proportion was 22.5%. There is, however, a pronounced disparity between small and large credit unions. While 99.5% of the 1,000 largest credit unions were offering real estate mortgages in 1999, only 5.6% of the smallest 1,000 were doing so. Similar patterns emerge for other product lines. The proportions of the 1,000 largest credit unions offering share drafts and IRA and Keogh accounts were 98.7% and 98.2% respectively. Among the smallest 1,000 credit unions the equivalent proportions were 0.8% and 2.2%. Differences between the composition of the product portfolios of large and small credit unions can be expected to have implications for their relative growth performance. To the extent that larger credit unions are becoming more diversified by moving into new areas of business, such differences may also have implications for the relationship between size and variability in growth.

As is the case for commercial banks and thrift organisations, both state and federal governments charter credit unions. State laws, which vary from state to state, govern state-chartered credit unions' common bond limits and powers. Reichert and Rubens (1994) argue that state regulations are typically more liberal than federal regulations. Consequently, state chartered credit unions operating in a competitive environment are expected to exploit any competitive advantage associated with their charter. They may assume more risk, measured by higher loan-to-share and loan-to value ratios; more aggressive portfolio management techniques; and perhaps higher capital-to-asset ratios to offset the higher risk.¹⁰ Set against this state credit unions are unable to branch across state lines. Consequently their growth potential (and particularly that of the larger state credit unions) may be constrained. In the multivariate estimations, intercept and slope dummy variables are used to allow for variations in the size-growth relationship between state and federal credit unions.

A number of commentators have argued that much of the recent growth in credit unions' share of consumer lending, which in 1999 stood at 13%, was driven by the more liberal approach adopted by the NCUA to the interpretation of the common bond in the early 1980s. Following this change, multiple common bond credit unions were permitted. Later the NCUA extended this policy to allow credit unions in financial difficulty to merge. For example downsizing or closure of manufacturing firms, military bases and other large employers significantly reduced the membership base of many

¹⁰ The National Credit Union Share Insurance Fund insures individuals' shares of all federal credit unions and a majority of state credit unions. The remaining state credit unions secure share insurance from various state and private funds.

occupational credit unions. Consequently, relaxation of common bond requirements has been important in permitting credit unions to sustain growth, or even to survive. In the multivariate estimations, intercept and slope dummy variables are used to allow for variations in the size-growth relationship between single and multiple common bond credit unions.

Barron et al (1994) argue that as organisations grow older, they become increasingly vulnerable to competition from newcomers. This view is consistent with younger organisations being more innovative and dynamic than their older counterparts. There is an alternative viewpoint, that large organisations enjoy advantages arising from experience, the ability to collude with established partners, and the exercise of market power. Collusion and the exercise of market power to the detriment of other credit unions is very much against the co-operative ideal. The legislative framework may, however, confer just such an age advantage, since regulators tend to charter only new credit unions that do not replicate charters of existing credit unions. Furthermore, while US credit unions have increasingly embraced the concept of multiple common bonds, the position of the NCUA remains one of avoiding overlapping fields of membership if possible. This may suggest that longer-established credit unions have an in built growth advantage. To examine the relevance of these competing hypotheses, age is included as an explanatory variable in the multivariate analysis.

For each credit union, data is available on potential membership given the coverage of its common bond. Clearly, credit unions that are close to exhausting their potential membership, face difficulties in sustaining strong growth performance. The expectation is that a credit union with a high ratio of actual to potential members has less scope for growth than one with a low ratio.

A number of time-varying credit union financial structure and performance indicators are also included in the multivariate analysis. First, it is expected that a high return on assets should contribute positively to credit union growth. Second, the cost-to-income ratio (with cost defined as operating expenses) captures operational efficiency. A high cost-to-income ratio suggests inefficient performance and should impact negatively upon growth. Third, the capital-to-assets ratio is included, though there are contrasting hypotheses concerning the expected relationship with growth. One possibility is that a solid capital base is necessary to sustain asset growth, in which case a positive relationship is expected. Alternatively, credit unions with above average capital ratios may be operating over-cautiously, in which case their growth performance may be impaired. Finally, the proportion of a credit union's loan portfolio considered to be delinquent is included, even though the relationship between the bad debt ratio and growth is not immediately clear. On the one hand credit unions that attempt to expand too quickly may experience high bad debt levels, resulting in a positive relationship between the bad debt

ratio and growth. On the other hand a high bad debt ratio may indicate a poorly run credit union. If so poor management is also likely to affect other aspects of operational and organisational structure, resulting in below-average growth.

The estimations explore whether growth patterns differ between sub-sectors defined by common bond categories. The NCUA codes credit unions on the basis of 35 different categories.¹¹ Differences may be expected to exist in the membership characteristics, the operational structure and the level of subsidies available to credit unions in different categories. Credit unions classified as ‘low income’, for example, can be expected to differ significantly on all three counts from those in other categories. To examine whether growth patterns differ between common bond sub-sectors, the estimations were repeated with the sample divided into eight broadly defined categories: 1. community (other than low income); 2. associational (religious, fraternal and other than low income); 3. educational, military, federal, state and local government; 4. manufacturing (single bond); 5. service (single bond); 6. educational, military, federal, state and local government, manufacturing and service (multiple bond); 7. low income (community and associational); and 8. other codes.

The data set is constructed from financial information published by US credit unions in their ‘5300 Call Reports’ and made available in differing forms by the NCUA and Callahan and Associates. Information is compiled on a semi-annual basis for the period 1990 to 1999, providing a total of twenty time series observations on each union. As of December 1999 there were 10,858 US credit unions in the database. Credit unions for which data were not available in continuous form throughout the sample period were eliminated from the sample. Such cases include credit unions that formed after 1990; those that failed; and those that lost their independence as a result of acquisition by other credit unions. Furthermore, not all credit unions provide complete, consistent and believable information.¹² Elimination of those credit unions with incomplete or unusable data reduced the sample size to 7,787. The database identifies surviving credit unions that were involved in mergers with other credit unions at any point during the sample period, but does not indicate the time at which the merger took place or the identity of the non-surviving partner. The number of survivors identified as having been involved in mergers was 184, or 2.4% of the total. So as to focus primarily upon internally generated growth, these cases were also eliminated, reducing the sample size for surviving, non-merging credit unions with

¹¹ Credit unions in the manufacturing sector, for example, are classified under the following headings: chemicals, petroleum refining, primary and fabricated metals, machinery, transportation equipment and ‘other’. Each categorisation also distinguishes between credit unions that have opted to incorporate “select employee groups” and those that are essentially single common bond credit unions. Consequently within manufacturing there are 12 differently coded categories; in the service sector there are eight.

¹² Using 1990 data, Fried and Lovell (1993) reduced an original data set of 13,882 credit unions to 8,947 after eliminating cases with incomplete or unusable data.

complete and useable data to 7,603. This group forms the sample for the majority of the estimations reported below. However, to investigate whether the sample selection procedure may have created an element of selection bias, a limited number of estimations are also reported for two separate samples: first, the 184 credit unions with complete data and involved in mergers; and second, 1,059 credit unions with incomplete but believable and useable data, most of which appear to have been non-survivors.

For the main sample of 7,603 credit unions, Table 1 presents summary data (means and standard deviations) on the size (assets and membership) and other variables described above. These data refer to the end-point of the sample period (12.99). Table 1 also reports summary data on asset and membership growth over the full sample period (12.90 to 12.99). All data are subdivided into the eight common bond categories described above. In terms of absolute values of the two size measures, the multiple common bond credit unions are larger on average than those in any of the single common bond categories. Community credit unions, however, are similar in terms of average membership to multiple common bond credit unions, though somewhat smaller in terms of average asset size. The educational, military and government credit unions group contains some of the largest credit unions, including '5536 Navy', based at Merrifield Virginia (with assets of \$11.2bn in 12.99), which is almost three times as large as any other US credit union.

All common bond categories experienced significant average growth in assets between 1990 and 1999, but some groups (especially the associational and manufacturing single common bond categories) experienced only marginal increases in membership. In contrast, the community and low-income single common bond and the multiple common bond categories experienced rapid membership growth. When commentators emphasise that credit unions have expanded membership, with 30% of Americans now belong to a credit union, it is primarily to the community and multiple common bond categories that they refer.

III. ECONOMETRIC METHODOLOGY

Section III describes the econometric methodology used to estimate the growth equations reported in Section IV.

Univariate model

Univariate tests of the law of proportionate effect (LPE) are based on a model in which logarithmic credit union size and logarithmic growth (the first difference of log size) are the only variables. In these tests, it is assumed that the data generating process is:

$$s_{it} - s_{it-1} = \alpha_i + \delta_t + (\beta - 1)s_{it-1} + u_{it}; \quad u_{it} = \rho u_{it-1} + \varepsilon_{it} \quad [1]$$

[1] is a first order autoregressive model for s_{it} , the natural logarithm of the size of credit union i at time t . The values of the parameters in [1] determine the behaviour of log size over time. α_i and δ_t allow for individual and time effects respectively. β describes the relationship between size and growth. ρ captures serial correlation (if any) in u_{it} , the error term in the growth equation. ε_{it} , a random disturbance, is assumed to be normal, independent and identically distributed (IID) with $E(\varepsilon_{it})=0$ and $\text{var}(\varepsilon_{it}) = \sigma_\varepsilon^2 > 0$.

If $\beta \geq 1$ in [1] it is assumed that $\alpha_i=0$ for all credit unions. $\alpha_i \neq 0$ would allow for a deterministic trend specific to each credit union, which could exist but which would be very difficult to identify with fewer than 20 observations per credit union. The possibility of a common deterministic trend is captured, however, through the time effects δ_t . $\beta > 1$ implies growth trajectories that are explosive, while $\beta = 1$ implies growth is non-explosive and unrelated to size. If $\beta = 1$ the LPE is accepted. If $\beta < 1$ credit union sizes are mean-reverting. In this case the interpretation of α_i is different: $\alpha_i/(1-\beta)$ is the average log size to which credit union i tends to revert in the long term. It is therefore necessary to assume $\alpha_i > 0$. Cross sectionally, α_i can be considered as being IID with $E(\alpha_i)=0$ and $\text{var}(\alpha_i)=\sigma_\alpha^2 \geq 0$. If $\sigma_\alpha^2=0$, the individual effects are identical: the size of all credit unions tend to revert towards the same long-term average value. If $\sigma_\alpha^2 > 0$, the individual effects are heterogeneous: the average values toward which credit unions converge in size in the long term are specific to each union.

In Section IV, both cross sectional and panel tests of the LPE are reported. Most previous empirical studies are based on cross sectional estimation of a regression of growth over a certain period on initial size (and in many cases, a lagged growth term). Assuming T , the number of time periods over which growth is observed, exceeds one period in [1], the cross sectional model can be obtained by reparameterising [1] as follows:

$$s_{iT+1} - s_{i1} = a_i + (b - 1)s_{i1} + r(s_{i1} - s_{i0}) + v_{iT+1} \quad [2]$$

where $b=\beta^T$ and a_i , r and v_{iT+1} are transformations of α_i , ρ and ε_{it} . [2] is estimated over $i=1 \dots N$, where N is the number of credit unions in the sample.

For [2] to be estimable an assumption of homogeneity in α_i (and therefore in a_i) is required; otherwise

the number of parameters in [2], $N+2$, exceeds the number of cross sectional observations, N . If $\sigma_{\alpha}^2 = 0$, we can write $\alpha_i = \alpha$ and $a_i = a$. Breitung and Meyer (1994) and Goddard et al (2000) have shown that if $\sigma_{\alpha}^2 > 0$ but [2] is estimated assuming $a_i = a$, the resulting estimator of b is upward biased and inconsistent. The standard test of the LPE using the t-statistic on $\hat{b} - 1$ has low power and is loaded towards ‘acceptance’ of the LPE. Effectively, cross-sectional estimation of the relationship between size and growth excludes the possibility that credit union sizes revert toward different long-term equilibrium values. Recent advances in the econometric analysis of panel data sets, however, permit estimation and tests of the LPE without imposing any such conditions.

For the purposes of panel estimation [1] can be re-written as follows:

$$s_{it} - s_{it-1} = \alpha_i(1 - \rho) + \delta_t + (\beta - 1)s_{it-1} + \rho(s_{it-1} - s_{it-2}) + \eta_{it} \quad [3]$$

where $\eta_{it} = \varepsilon_{it} + \rho(1 - \beta)s_{it-2}$

An important property of [3] is that the form of η_{it} does not present any problems for tests of $H_0: \beta=1$ because $\eta_{it} = \varepsilon_{it}$ under H_0 . The fixed effects estimator could be applied to [3], but the resulting estimator of β is downward biased, and the sampling distribution of its t-statistic is non-standard. This estimator also produces a full set of estimates of the individual effects α_i , which may not be required if the main objective is to investigate the size-growth relationship. Breitung and Mayer (1994) suggest an alternative approach, which involves deducting the first observation (s_{i0}) for each firm from the right hand side of [3] and incorporating the individual effects into the error term. The estimable model is as follows:

$$s_{it} - s_{it-1} = \delta_t + (\beta - 1)(s_{it-1} - s_{i0}) + \rho(s_{it-1} - s_{it-2}) + \xi_{it} \quad [4]$$

where $\xi_{it} = \eta_{it} + \alpha_i(1-\rho) + (\beta-1)s_{i0}$

The Breitung-Mayer panel estimator, denoted $\hat{\beta}$, is unbiased under $H_0: \beta=1$, while the t-statistic on $\hat{\beta}-1$ is asymptotically normal. If $\beta < 1$, $\hat{\beta}$ is upward biased because of the presence of $(\beta-1)s_{i0}$ in ξ_{it} . Breitung and Mayer (1994) show that the bias is $\beta + (1-\beta)/2$. Unlike the cross-sectional estimator, however, the properties of $\hat{\beta}$ under H_0 are unaffected by heterogeneity in α_i . [4] is estimated over $i = 1 \dots N$ and $t=3 \dots T+1$.

Multivariate model

The multivariate model is based on expanded versions of [2] and [3], incorporating additional independent variables on the right hand side of each equation:

$$s_{iT+1} - s_{i1} = a + (b - 1)s_{i1} + r(s_{i1} - s_{i0}) + g_1' x_i + g_2' \bar{z}_i + v_{iT+1} \quad [5]$$

$$s_{it} - s_{it-1} = \alpha(1 - \rho) + \delta_t + (\beta - 1)s_{it-1} + \rho(s_{it-1} - s_{it-2}) + \gamma_1' x_i + \gamma_2' z_{it} + \eta_{it} \quad [6]$$

where x_i is a vector of time-invariant characteristics of credit union i ; z_{it} is a vector of time-varying characteristics; $\bar{z}_i = (1/T) \sum_{t=2}^{T+1} z_{it}$; and g_1 , g_2 , γ_1 and γ_2 are vectors of coefficients. In [5] and [6] it is assumed that all cross sectional heterogeneity between credit unions is captured by x_i and z_{it} , so the problem of heterogeneous individual effects does not arise in the multivariate estimations. [5] is estimated over $i=1 \dots N$, and [6] is estimated over $i=1 \dots N$ and $t=2 \dots T+1$.

Equations [2], [4], [5] and [6] permit direct tests of the first two of Tschoegl's (1983) three testable propositions: that growth rates are independent of firm size (in which case $b=\beta=0$); and that growth does not persist ($r=\rho=0$). The third proposition, that the variability of growth is independent of size, can be investigated by applying a standard heteroscedasticity test to the residuals of each estimated equation. A Lagrange Multiplier (LM) test based on an auxiliary regression of the squared residuals in [2], [4], [5] or [6] on the squared lagged size measure, s_{i1}^2 in [2] and [5] or s_{it-1}^2 in [4] and [6], produces a heteroscedasticity test statistic distributed χ^2_1 under the null hypothesis of homoscedasticity. When the null is rejected, the sign of the estimated coefficient on the squared initial size measure in the auxiliary regression is of interest, as it indicates the direction of the relationship between credit union size and the variability of growth.

In the estimations reported in Section IV, the logarithmic size and growth variables based on the assets size measure are calculated from nominal data. The membership size variable, in contrast, is real. However, the specifications of [2], [4], [5] and [6] ensure that the estimation of the coefficients of interest are unaffected by the choice between nominal or real data for the assets measure. The effects of inflation (present in the nominal assets data) as well as any growth which is common to all credit unions (due perhaps to business cycle fluctuations, and present in both the nominal assets and real membership data) are captured entirely by the constant term in the cross sectional models and by the time dummies in the panel models. The estimation of the parameters b , r , g_1 and g_2 in [2] and [5], and β , ρ , γ_1 and γ_2 in [4] and [6] is therefore unaffected by the choice between nominal and real size definitions, or by any nominal or real inflation or growth that affects all credit unions equally.

Results in Section IV are reported for three estimation periods: the full sample period 12.90-12.99; and the two sub-periods 12.90-6.95 and 6.95-12.99. For each credit union the data set provides 20 observations on size (from 6.90 to 12.99), one of which is lost when growth is calculated, and another when lagged growth is included in the model. This leaves $T=18$ observations for the multivariate panel estimations over the full sample period 12.90-12.99. In the notation of Section IV, $t=0$ is 6.90; $t=1$ is 12.90; and so on until $t=19$ is 12.99. There are $T=9$ observations each for the estimations over the sub-periods 12.90-6.95 and 6.95-12.99. To obtain the necessary current and lagged growth rates, the estimations for the first sub-period utilise data from $t=0$ (6.90) to $t=10$ (6.95); and the estimations for the second utilise data from $t=9$ (12.94) to $t=19$ (12.99).

IV. EMPIRICAL RESULTS

Section IV presents and interprets the estimation results for the univariate and multivariate credit union growth equations. For convenience descriptive variable names (rather than mathematical symbols) are assigned to all dependent and independent variables. These are as follows:

	CROSS SECTIONAL ESTIMATIONS	PANEL ESTIMATIONS
DASS	log growth in assets over estimation period	log growth in assets over current six-month period
LASS	log assets at start of estimation period	log assets at start of current six-month period
LDASS	log growth in assets over six months prior to start of estimation period	log growth in assets over previous six-month period

DMEM, LMEM, LDMEM	Defined as above using the membership size measure	
AGE	log age at start of estimation period	log age at start of current six-month period
MPOT	log members <i>minus</i> log potential members at start of estimation period	log members <i>minus</i> log potential members at start of current six-month period
ROA	average return on assets over estimation period	return on assets for current six-month period
COINC	average cost-income ratio over estimation period	cost-income ratio for the current six-month period
CAP	average capital ratio over estimation period	capital ratio for current six-month period
BAD	average bad debt ratio over estimation period	bad debt ratio for current six-month period

Univariate tests of the LPE

Tables 2 and 3 report estimates of $b-1$ and $\beta-1$ (which identify the relationship between size and growth) in the univariate models [2] and [4] respectively. Table 2 is based on the assets size measure, and Table 3 on the membership measure. Also reported are estimates of r and ρ in [2] and [4] respectively. r in [2] reflects the relationship between growth over the six months before the start of the estimation period and growth over the estimation period, but does not have a direct interpretation as a measure of persistence from one six-month period to the next. ρ in [4] measures the direction and strength of persistence in growth between successive six-month periods. Finally, Tables 2 and 3 also report estimates of the coefficient on the squared lagged size measure in the auxiliary regressions derived from [2] and [4], together with the corresponding heteroscedasticity LM test statistic. In cases where heteroscedasticity is present, the coefficient identifies the direction of the relationship between size and the variability of growth. In most cases the error terms are heteroscedastic, so the reported t -statistics for \hat{b} , $\hat{\beta}$, \hat{r} and $\hat{\rho}$ are based on White's (1980) adjusted standard errors. In each table, estimates are reported for the full credit union sample, and for sub-sectors based upon the eight common bond categories.¹³

In the univariate cross sectional estimations based on [2], the coefficients on LASS and LMEM suggest that the LPE has little merit as a description of credit union growth patterns, irrespective of which size measure is used. For the full sample larger credit unions grew faster than their smaller counterparts in all estimation periods. For the common bond sub-sectors, the cross-sectional test again

¹³ It would be possible to allow for variations between sub-sectors or sub-periods in a more restrictive manner: for example, by incorporating some intercept or slope dummies into a single estimated equation. With 7,603 cross-sectional and over 129,000 ($7,603 \times 17$) panel observations available for the univariate estimations, however, there are clearly sufficient degrees of freedom to allow for possible variation in all coefficients between sub-sectors. Alternative specifications are not reported so as to avoid excessive proliferation of empirical results.

rejects $H_0:b=0$ (with positive estimates of b) for most sub-sectors for 12.90-12.99 and for 6.95-12.99. For 12.90-6.95 the evidence is more mixed: the tests fail to reject the LPE for all sub-sectors using the assets size measure, and for the community, associational and low-income sub-sectors using the membership size measure.

In the univariate panel estimations based on [4], using the assets size measure the LPE is rejected for the full sample, and for each of the eight common bond sub-sectors, in all estimation periods. Again the clear pattern is that larger credit unions grew faster than their smaller counterparts. Using the membership size measure, however, a rather more confused picture emerges. For the full sample and for each of the eight sub-sectors, the LPE cannot be rejected for the period 12.90-12.99. In the two sub-periods, however, negative and significant (at the 5% level) coefficient estimates for the full sample and for three sub-sectors suggests that small credit unions grow faster than larger ones between 12.90 and 6.95. But positive and significant coefficient estimates for the full sample and for four sub-sectors suggest the opposite pattern between 6.95 and 12.99. Overall the positive size-growth relationship seems to have been slightly stronger for the assets than for the membership size measure. Therefore the advantages of larger credit unions appear to have derived more from their superior capability to increase business with existing members, than from their superior capabilities in attracting new members.

The coefficients on LDASS and LDMEM indicate that negative persistence of growth is a robust result in the univariate panel estimations. On average, credit unions that achieve above-average growth in one period tend to grow more slowly in the next. In contrast, most studies of other industrial or financial sectors have found either no persistence of growth (Acs and Audretsch, 1992; Dunne and Hughes, 1994), or positive persistence (Chesher, 1979; Kumar, 1985; Wagner, 1992). Contini and Revelli's (1989) study of the growth of Italian manufacturers is one of the few to have found negative persistence. In the present case a failure to find evidence of positive persistence may reflect the fact that credit unions form part of a highly integrated and competitive financial system, within which prolonged above-average growth for individual institutions is unlikely. A finding of negative persistence may reflect the effects of reorganisation within institutions following bursts of rapid growth, with the subsequent emphasis on consolidation rather than further expansion.

Finally the null hypothesis of homoscedastic growth is rejected at the 1% level in almost all panel estimations of [4] using either size measure; and in most cross-sectional estimations of [2] using the assets size measure. In the estimations of [2] using the membership size measure there is a mix of acceptances and rejections of homoscedasticity. Whenever heteroscedasticity is detected a negative estimated coefficient on the squared lagged size variable is obtained in the auxiliary regression,

indicating an inverse relationship between size and the variability of growth.

Similar results for other industries have been reported in previous studies. Singh and Whittington (1968) and Dunne and Hughes (1994) argue that larger firms can more easily diversify, spreading risk over a wider range of production activities and making them less susceptible to fluctuations in growth.

Jovanovic (1982) argues that larger firms are likely to be older than smaller firms, and may benefit from learning economies of scale enabling them to avoid costly mistakes. The issue of differential management expertise between large and small institutions is relevant in the case of credit unions. The emphasis for small credit unions in the early stages of development is on educating volunteer leaders to carry out management responsibilities. Many volunteers have limited financial or management experience, creating the possibility of significant variability in performance. Large credit unions, many of which offer services similar to those of retail banks, have sophisticated management teams and a salaried workforce. Assuming some uniformity in the level of this expertise, it is likely that it will translate into relatively stable performance.

Multivariate growth equations

Tables 4 and 5 report estimates of the multivariate growth models [5] and [6], using the assets and membership size measures respectively. In these estimations both the intercept and slope coefficients on the lagged size variable (a and $b-1$ in [5]; α and $\beta-1$ in [6]) are permitted to vary between state credit unions with a single common bond (S/S); state credit unions with a multiple common bond (S/M); federal credit unions with a single common bond (F/S); and federal credit unions with a multiple common bond (F/M). Estimated intercepts are not reported in Tables 4 and 5, but separate estimates of $b-1$ and $\beta-1$ are shown for these four groups. In Tables 4 and 5 estimates are reported for the full credit union sample over each of the three estimation periods. As before, homoscedasticity is generally rejected, and t-statistics are based on White's adjusted standard errors.

For the period 12.90-12.99 the positive association between size and growth is most pronounced for credit unions that are single bond and state chartered. For federally chartered credit unions (both single and multiple common bond) this pattern is reversed, with an inverse relationship between size and growth. These findings support the Reichert and Rubens (1994) argument (see Section II) that the larger state credit unions tend to benefit most from the relatively liberal regulatory regimes at state level.

Overall, however, the estimated coefficients on LASS and LMEM in the multivariate models [5] and [6] are much closer to zero than their counterparts in the univariate models [2] and [4]. Indeed, for the sub-period 12.90-6.95 the multivariate estimations suggest in most cases an inverse size-growth

relationship; the main exception being the single bond state chartered category. It seems clear that the discrepancy in the estimated size-growth relationship between the univariate and multivariate estimations is due to the inclusion in the latter of the additional covariates, most of which are highly significant determinants of credit union growth (see below). Although large credit unions grew faster than small ones, they tended to do so for specific reasons: for example, because they were more efficient, or because they had lower capital or bad debt ratios. Credit union growth therefore depends ultimately upon various structural and operational variables, which nevertheless are to some extent correlated with size. The sample correlation coefficients between LASS and the four financial structure/performance covariates (calculated across all observations from 12.90 to 12.99) are -0.008 (ROA), -0.134 (COINC), -0.350 (CAP) and -0.330 (BAD). The correlations between LMEM and the same four covariates are -0.013, -0.012, -0.379 and -0.293 respectively. These suggest that large credit unions were slightly less profitable than small ones (although the relationship is weak). On the assets but not on the membership size measure, however, large credit unions were more cost efficient. And the larger credit unions generally operated with lower capital ratios and lower bad debt ratios.

The estimated coefficients on LDASS and LDMEM in the multivariate panel estimations of [6] suggest that there was significant negative persistence of growth, as in the univariate case. Tables 4 and 5 are also consistent in suggesting that age impacts negatively on growth.

“There is a widespread belief that older (usually larger) organisations become ossified, finding it more difficult to make and carry out decisions in a timely manner. From this perspective, old age and large size are equated with a loss of agility and responsiveness, so that, with ageing, more market opportunities are missed and fewer pitfalls and dangers of the market are avoided - with predictable consequences for the life changes of the organisation” (Barron et al, 1994, pxx).

The empirical results appear to support this view in the case of US credit unions. It must be emphasised, however, that in general larger credit unions grew faster than their smaller counterparts, and that there is a positive relationship between size and age. The correlation coefficient between LASS and AGE is 0.248, and the correlation between LMEM and AGE is 0.201. But after controlling for size and other determinants of growth, negative coefficients on AGE suggest that there is a dynamism in younger credit unions which translates into stronger growth performance than would be expected from older credit unions of the same size.

The ratio of actual to potential membership available to the credit union given the coverage of its common bond is also an important determinant of growth. The estimated coefficients on MPOT are consistently negative and significant, indicating that credit unions close to exhausting their potential

membership face difficulties in sustaining strong growth performance. Therefore common bond coverage does appear to impose a significant constraint on credit union growth.

The four financial structure/performance variables also turn out to be significant in most of the estimated equations. The signs of the coefficients on ROA are positive, suggesting that credit unions earning a high return on assets are reinvesting in order to secure growth. The signs of the coefficients on COINC are negative, suggesting that the fastest growth is achieved by the more cost-efficient credit unions. Examining the relationship between asset size and average cost, Emmons and Schmid (1999) find that average costs increase slightly with asset size for the smallest credit unions. Subsidies (such as rent-free office space, volunteer workers, and so on) tend to be relatively more important for the smallest credit unions. At the upper end of the size distribution, however, the costs associated with these kinds of item become less significant. Average costs tend to decrease, with no evidence of a flattening of the long run average cost curve even at the largest asset sizes. Larger credit unions are the most cost-efficient, and tend to grow faster.

A significant negative relationship between CAP and growth is identified in Tables 4 and 5. This tends to support the case made in Section II that credit unions with above-average capital ratios may be operating over-cautiously, choosing to build up reserves rather than exploiting potentially productive investment opportunities. A significant negative relationship between BAD and growth is also obtained. As suggested previously, high levels of bad debt may be symptomatic of a poorly run credit union. Poor management is likely to affect other aspects of the operational and organisational structure, resulting in below-average growth. In addition, if bad debt information is publicly available, existing members may decide to leave the credit union and potential members may be deterred from joining. Clearly such behaviour also impacts adversely upon growth.

Tables 6 reports multivariate panel estimations of [6] for the eight common bond sub-sectors. In view of the volume of information, results are reported only for the panel specification and only for the 12.90-12.99 estimation period. Because the common bond sub-sectors distinguish between the single and multiple common bond categories, separate estimates of $b-1$ and $\beta-1$ are reported only for state and federally chartered credit unions. In general the estimated coefficients are similar in size and magnitude to those reported in Tables 4 and 5. But as a result of the smaller numbers of observations used in the common bond sub-sector estimations, some individual coefficient estimates are not statistically significant. In common with earlier results, the tendency for large credit unions to grow faster appears to be more pronounced for state than for federal credit unions.

Finally, Table 7 presents multivariate panel estimation results based on [6] for three separate groups:

first, the main sample of 7,603 surviving credit unions not involved in mergers; second, the 184 surviving credit unions that were involved in mergers; and third, 1,059 predominantly non-surviving credit unions with incomplete data (see Section II). The results for the first of these groups are reproduced from Tables 4 and 5, and are included in Table 7 for comparative purposes only.

The results for the mergers group do not seem markedly different to those for the main sample. One minor difference is that on both size measures, the positive and significant relationship between size and growth among the non-merging state chartered single common bond credit unions does not hold for their direct counterparts involved in mergers. The variation in the numerical magnitudes of the estimated β 's between the non-merger and merger groups, however, is small. With the single exception of the coefficient on DLASS in the assets estimation, all other estimated coefficients for the merger group have the same signs as those for the non-merger group. Minor variations in the numerical magnitudes of estimated coefficients probably reflect sampling error, while the merger group's smaller sample size explains the lower number of statistically significant coefficients.

There are some perhaps more consistent differences between the results for the main sample and those for the group with incomplete data. For the latter, the estimated β 's are negative, and are smaller than their counterparts for the main sample. For non-survivors, therefore, the size-growth relationship appears to be predominantly negative. This pattern could be explained if slow growth increases the risk of non-survival for larger credit unions, but is not associated with the same risk for smaller credit unions; or if excessively rapid expansion on the part of a small credit union actually increases the risk of non-survival through take-over or failure. For the group with incomplete data the coefficients on AGE are both positive (one is significant and one insignificant), whereas the same coefficients for the main sample are negative. Finally there are a few other minor variations in the signs and statistical significance of individual coefficients on other covariates between the group with incomplete data and the main sample.

V. CONCLUDING COMMENTS

The US credit union movement developed in order '*to make available to people of small means credit for provident purposes*' (Federal Credit Union Act 1934). Credit unions were viewed as member-owned democratic institutions, with an ethos emphasising self-help and voluntarism especially among weaker, disadvantaged segments of society. Credit unions pursue a range of social, educational

and developmental objectives. Consequently credit unions have traditionally been treated differently to banks. Federal credit unions, for instance, enjoy a tax-exempt status, which currently survives despite vigorous legal challenge on the grounds that credit unions are no longer dedicated to their traditional social purpose. Following liberalisation of the common bond and fields of membership regulations, the opportunity to extend membership has been seized by many credit unions, as is evident from the fact that some 30% of Americans now belong to a credit union. The recent legal victory by credit unions over banks suggests that this growth is likely to continue in the foreseeable future.

Employing both cross sectional and panel methodologies, this paper has analysed patterns of credit union growth in the US during the 1990s. A univariate analysis has been used to test three hypotheses deriving from the law of proportionate effect (LPE) which, if accepted, would suggest that a skewed credit union size distribution is the cumulative outcome of a series of essentially random shocks to credit union size. In the event, however, all three hypotheses are rejected in tests using different empirical methodologies and different size measures, and over a range of estimation periods and credit union sub-sectors. Large credit unions grew faster than small credit unions during the 1990s. There is evidence of negative persistence between growth rates in successive periods. And there is evidence that growth is more variable among small than among large credit unions. The positive size-growth relationship appears to have been slightly stronger for the assets than for the membership size measure. Therefore the advantages of larger credit unions derived more from being able to increase business with existing members than from being able to attract new members.

The empirical results show evidence of negative persistence in growth rates, and an inverse relationship between size and variability in growth. It is suggested that negative persistence may reflect the fact that prolonged above-average growth for individual institutions is unlikely within a highly competitive financial system, while periods of fast growth may tend to be punctuated by quieter periods of consolidation within individual credit unions. The lower variability in the growth of the larger credit unions may reflect the benefits of product diversification and learning economies of scale that are more easily available to large institutions.

The rejection of the LPE in the univariate estimations does not tell the full story, however. While credit unions share a common co-operative philosophy, differences are also apparent across a range of operational and structural characteristics such as age, charter type, common bond group; and in the financial structure and performance of the credit union as measured by return on assets, cost efficiency, capital adequacy and bad debt exposure. In multivariate estimations these structural and operational covariates all proved to be highly significant determinants of credit union growth. In general the inclusion of these additional explanatory variables tends to weaken the earlier finding that credit

union size (as such) was a significant determinant of growth. Although large credit unions grew faster than small ones, they tended to do so for specific reasons: because they were more efficient, or because they had lower capital or bad debt ratios. Size itself, in other words, is not the ultimate determinant of growth. Rather, growth depends ultimately on structural and operational covariates, which are nevertheless correlated to some extent with credit union size.

The multivariate results also provide some specific and some circumstantial evidence of constraints on growth. Specifically, growth of both assets and membership is inversely related to the ratio of actual to potential members defined by the credit union's common bond coverage. A tendency for growth to be constrained as membership approaches its maximum is therefore discernible statistically in the data. Age also appears to act as a constraint on growth: while older credit unions tend to be bigger on average, after controlling for size and other determinants of growth younger institutions appear to be more dynamic. More circumstantial evidence of constraints on growth is provided by the fact that while larger state chartered single bond credit unions grew faster than their smaller counterparts, for federally chartered credit unions (both single and multiple bond) this pattern was reversed. This may reflect the effects of a relatively liberal regulatory framework at state level, enabling the larger credit unions to exploit growth opportunities. Conversely, the more restrictive framework that operates at federal level may impose constraints on the growth of the larger federally chartered credit unions.

REFERENCES

- Acs, Z.J. and Audretsch, D.B. (1992), *Innovation and Small Firms*. Cambridge: Cambridge University Press.
- Alhadeff, D.A. and Alhadeff, C.P. (1964), Growth of Large Banks, 1930-1960, *Review of Economics and Statistics*, 46, 356-363.
- Amburgey, T.L. and Dacin, M.T. (1993), Evolutionary Development of Credit Unions, Centre for Credit Union Research, The School of Business, University of Wisconsin-Madison, 44 pages.
- Barron, D.N. (1992), *Credit Unions: Density-Dependent Evolution*.
- Barron, D.N., West, E. and Hannon, 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, 2, 381-421.
- Berger, A.N., Hunter, W.L. and Timme, S.G. (1993), The Efficiency of Financial Institutions: A Review and Preview of Research Past, Present and Future, *Journal of Banking and Finance*, 17, 221-249.
- Berger, A.N. and Humphrey, D.B. (1997), Efficiency of financial institutions: International Survey and directions for future research, *European Journal of Operations Research*, 98, 175-212.
- 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*, 2-4, 135 – 194.
- Breitung, J. and Meyer, W., (1994), Testing for Unit Roots in Panel Data: Are Wages on Different Bargaining Levels Cointegrated? *Applied Economics*, 26, 353-361.
- Chesher, A. (1979), Testing the Law of Proportionate Effect, *Journal of Industrial Economics*, 27, 403-411.
- Contini, B. and Revelli, R., (1989), The Relationship Between Firm Growth and Labour Demand, *Small Business Economics*, 1, 309-314.
- Credit Union Services Profile (1997), Madison: Credit Union National Association
- Dunne, P. and Hughes, A., (1994), Age, Size Growth and Survival: UK Companies in the 1980's, *Journal of Industrial Economics*, 42, 115-140.
- Emmons, W.E. and Schmid, F.A. (1999), Credit Unions and the Common Bond, *Federal Reserve Bank of St. Louis*, September/October 1999, 41-64.
- Evans, D.S., (1987), Tests of Alternative Theories of Firm Growth, *Journal of Political Economy*, 95, 657-674.
- Fried, H.O., and Lovell, C.A.K., (1993), Evaluating the Performance of US Credit Unions, Madison, WI, The Filene Research Institute.
- Gibrat, R., (1931), *Les Inegalities Economiques*, Paris: Sirey.

- Goddard, J.A., Wilson, J.O.S. and Blandon, P. (2000), Panel tests of Gibrat's Law for Japanese manufacturing, *International Journal of Industrial Organization*, forthcoming.
- Hart, P.E. and Prais, S.J., (1956), The Analysis of Business Concentration: A Statistical Approach, *Journal of the Royal Statistical Society, Series A*, 119, 150-191.
- Hart, P.E. and Oulton, N. (1996), The Size and Growth of Firms, *Economic Journal*, 106, 1242-1252.
- Hart, P.E. and Oulton, N. (1999), 'Gibrat, Galton and job creation' *International Journal of the Economics of Business*, 6, 149-164
- Jovanovic, B., (1982), Selection and Evolution of Industry, *Econometrica*, 50, 649-670.
- Kumar, M.S., (1985), Growth, Acquisition Activity and Firm Size: Evidence from the UK, *Journal of Industrial Economics*, 33, 327-338.
- Lemmon, N., (1995), Credit Unions – The Next Generation, *Credit Union Executive*, January/February 1995, 14-17.
- Murray, J.D. and White, R.W., (1983), Economies of Scale and Economies of Scope in Multiproduct Financial Institutions: A Study of British Columbia Credit Unions *The Journal of Finance*, 38, 3, 887-902.
- Neven, D., Nuttall, R., and Seabright, P. (1993), *Merger in Daylight: The Economics and Politics of European Merger Control*. London: Centre for Economic Policy Research.
- Neven, D., Papandropoulos, P. and Seabright, P. (1998), *Trawling for Minnows: European Competition Policy and Agreements Between Firms*. London: Centre for Economic Policy Research.
- Overstreet, G.A. and Rubin, G.M. (1990), A Dynamic Theory of the Credit Union, Working Paper, Filene Research Institute, Center for Credit Union Research, University of Wisconsin – Madison.
- Reichert, A.K. and Rubens, J.H. (1994), Risk Management Techniques Employed Within the US Credit Union Industry, *Journal of Business Finance and Accounting*, 14-35.
- Rhoades, S.A. and Yeats, A.J. (1974), Growth, Consolidation and Mergers in Banking, *Journal of Finance*, 29, 1397-1405.
- Rose, P.S. (1987), *The Changing Structure of American Banking*. New York: Columbia University Press.
- Samuals, J.M. and Chesher, A.D., (1972), Growth, Survival and Size of Companies, 1960-1969 in Cowling, K. (ed.) *Market Structure and Corporate Behaviour*, London: Gray-Mills.
- Shepherd, W.G. (1997), *The Economics of Industrial Organization*. New Jersey: Prentice-Hall
- Smith, D.J. (1986), A Test for Variant Objective Functions in Credit Unions, *Applied Economics*, 18, 959-970.
- Singh, A. and Whittington, G. (1968), *Growth, Profitability and Valuation*. Cambridge, Cambridge University Press.

Singh, A. and Whittington, G. (1975), The Size and Growth of Firms, *Review of Economic Studies*, 42, 15-26.

Tschoegl, A.E., (1983), Size, growth and transnationality among the World's Largest Banks, *Journal of Business*, 56, 187-201.

Vander Venet, R., (1999), The Law of Proportionate Effect and OECD Banking Sectors, Working Paper, University of Ghent, Belgium.

Wagner, J. (1992), Firm Size, Growth and the Persistence of Chance, *Small Business Economics*, 4, 125-131.

White, H. (1980) A heteroscedasticity-consistent covariance matrix estimator and a direct test for heteroscedasticity, *Econometrica*, 48, 817-38.

Wilson, J.O.S. and J. Williams (2000) 'The size and growth of banks: Evidence from four European countries' *Applied Economics*, 32, 1101-1109.

Wolken, J.D. and Navratil, F.J., (1984), The Valuation of Subsidies in Kind and their Effects on Costs. *Journal of Economics and Business*, 36, 217-232.

World Council of Credit Unions (1997), *Annual and Statistical Report for 1997*.

Yeats, A.J., Irons, E.D. and Rhoades, S.A.. (1975), An Analysis of New Bank Growth, *Journal of Business*, 48, 199-203.

Table 1 Summary statistics, US credit unions data set, December 1999

	Common bond categories								
	All	1	2	3	4	5	6	7	8
Numbers of CUs									
Total	7603	546	471	1039	858	624	2638	96	1331
Federal	4703	266	278	599	529	413	2178	89	351
State/Other	2900	280	193	440	329	211	460	7	980
Means and standard deviations (<i>in italics</i>)									
Assets ('000s)	38424 <i>13798</i> <i>0</i>	45025 <i>81338</i>	14664 <i>52455</i>	29206 <i>12004</i> <i>9</i>	14430 <i>58276</i>	24028 <i>14102</i> <i>1</i>	58717 <i>19010</i> <i>7</i>	14532 <i>25269</i>	35041 <i>95191</i>
Age (years)	27.6 <i>11.3</i>	29.9 <i>11.3</i>	24.7 <i>10.1</i>	28.9 <i>12.2</i>	25.6 <i>11.0</i>	27.0 <i>11.8</i>	27.6 <i>10.7</i>	22.8 <i>10.7</i>	28.7 <i>11.4</i>
Members	7082 <i>18867</i>	9249 <i>13072</i>	2530 <i>6713</i>	5147 <i>18941</i>	2423 <i>6743</i>	3230 <i>9996</i>	10661 <i>25157</i>	3974 <i>5830</i>	7256 <i>16618</i>
Potential members	27020 <i>12592</i> <i>2</i>	59977 <i>14496</i> <i>4</i>	16311 <i>10275</i> <i>8</i>	26764 <i>24052</i> <i>4</i>	6421 <i>23502</i>	9318 <i>49611</i>	29233 <i>87497</i>	29229 <i>72184</i>	34522 <i>12289</i> <i>7</i>
ROA (%)	0.71 <i>0.95</i>	0.70 <i>0.78</i>	0.57 <i>1.01</i>	0.83 <i>0.82</i>	0.62 <i>1.27</i>	0.75 <i>0.87</i>	0.71 <i>0.93</i>	0.64 <i>1.36</i>	0.71 <i>0.85</i>
Cost-inc (%)	3.78 <i>1.38</i>	4.06 <i>1.26</i>	3.59 <i>1.64</i>	3.52 <i>1.40</i>	3.68 <i>1.46</i>	3.51 <i>1.73</i>	3.89 <i>1.16</i>	4.76 <i>2.06</i>	3.85 <i>1.34</i>
Capital (%)	14.73 <i>6.25</i>	12.42 <i>4.83</i>	15.43 <i>6.29</i>	15.31 <i>6.54</i>	18.62 <i>8.18</i>	17.26 <i>7.34</i>	13.41 <i>4.79</i>	14.91 <i>8.49</i>	13.90 <i>5.27</i>
Bad debt (%)	1.93 <i>2.60</i>	1.61 <i>2.11</i>	3.81 <i>4.69</i>	1.85 <i>2.16</i>	2.78 <i>3.33</i>	2.05 <i>2.55</i>	1.43 <i>1.78</i>	4.06 <i>4.75</i>	1.71 <i>2.17</i>
Log growth in assets (%) 12.90-12.99	48.9 <i>39.6</i>	60.5 <i>41.0</i>	34.2 <i>43.0</i>	51.8 <i>36.0</i>	31.3 <i>40.9</i>	41.5 <i>38.4</i>	53.9 <i>36.9</i>	61.0 <i>54.2</i>	51.3 <i>38.7</i>
Log growth in members (%) 12.90-12.99	15.8 <i>39.1</i>	21.1 <i>48.8</i>	1.4 <i>44.2</i>	17.3 <i>36.2</i>	1.3 <i>39.3</i>	9.0 <i>40.0</i>	21.8 <i>38.3</i>	22.3 <i>45.8</i>	17.5 <i>30.6</i>

Notes: Common bond categories are:

1) Community; 2) Associational; 3) Educational, military and government; 4) Manufacturing; 5) Services; 6) Multiple; 7) Low income; 8) Other

Table 2 Tests of the LPE: univariate estimations, assets size measure

Dependent variable = DASS

Estimation ↓ period		Common bond category								
		All	1	2	3	4	5	6	7	8
Cross-sectional estimations (equation [2])										
12.90- 12.99	LASS	0.043* <i>15.07</i>	0.029+ <i>2.24</i>	0.05* <i>4.07</i>	0.039* <i>4.74</i>	0.045* <i>4.88</i>	0.026+ <i>2.34</i>	0.023* <i>4.42</i>	0.006 <i>0.22</i>	0.033* <i>4.54</i>
	LDASS	1.007* <i>10.14</i>	1.312* <i>3.65</i>	1.821* <i>4.46</i>	0.456+ <i>1.96</i>	0.869* <i>3.27</i>	1.128* <i>4.34</i>	0.994* <i>5.71</i>	1.175 <i>1.52</i>	1.112* <i>4.95</i>
	Hetero	-0.952* <i>249.3</i>	-1.15* <i>22.5</i>	-1.094* <i>11.8</i>	-0.708* <i>20.9</i>	-0.383 <i>3.2</i>	-0.952* <i>20.3</i>	-0.916* <i>107.5</i>	-2.342* <i>8.1</i>	-1.15* <i>55.4</i>
12.90- 6.95	LASS	0.006* <i>3.48</i>	0.002 <i>0.21</i>	0.012 <i>1.58</i>	0.004 <i>0.76</i>	0.001 <i>0.26</i>	-0.008 <i>-1.05</i>	-0.001 <i>-0.21</i>	-0.022 <i>-1.10</i>	0.002 <i>0.50</i>
	LDASS	0.419* <i>5.96</i>	0.801* <i>2.82</i>	1.109* <i>4.26</i>	-0.112 <i>-0.66</i>	0.159 <i>0.83</i>	0.375+ <i>2.12</i>	0.457* <i>4.36</i>	0.712 <i>1.16</i>	0.705* <i>4.53</i>
	Hetero	-0.381* <i>222.2</i>	-0.282* <i>7.0</i>	-0.578* <i>19.4</i>	-0.332* <i>26.5</i>	-0.290* <i>11.9</i>	-0.407* <i>16.9</i>	-0.367* <i>79.8</i>	-1.097* <i>10.5</i>	-0.351* <i>31.9</i>
6.95- 12.99	LASS	0.040* <i>25.06</i>	0.026* <i>3.72</i>	0.042* <i>7.31</i>	0.041* <i>10.10</i>	0.054* <i>9.57</i>	0.049* <i>8.07</i>	0.029* <i>10.79</i>	0.038* <i>2.89</i>	0.031* <i>6.85</i>
	LDASS	0.783* <i>15.26</i>	1.056* <i>5.64</i>	1.165* <i>6.71</i>	0.510* <i>3.89</i>	0.735* <i>4.85</i>	0.277 <i>1.53</i>	0.839* <i>9.66</i>	0.679+ <i>2.18</i>	0.877* <i>6.81</i>
	Hetero	-0.310* <i>224.9</i>	-0.378* <i>31.2</i>	-0.124 <i>2.0</i>	-0.252* <i>23.7</i>	-0.275* <i>10.6</i>	-0.330* <i>13.4</i>	-0.309* <i>123.0</i>	-0.236 <i>0.6</i>	-0.357* <i>43.4</i>
Panel estimations (equation [4])										
12.90- 12.99	LASS	0.051* <i>64.46</i>	0.041* <i>14.93</i>	0.040* <i>12.08</i>	0.057* <i>26.62</i>	0.051* <i>19.99</i>	0.051* <i>19.06</i>	0.051* <i>41.75</i>	0.043* <i>6.12</i>	0.042* <i>24.37</i>
	LDASS	-0.114* <i>-22.67</i>	0.022 <i>1.38</i>	0.024 <i>1.34</i>	-0.251* <i>-16.60</i>	-0.134* <i>-9.60</i>	-0.170* <i>-10.61</i>	-0.132* <i>-16.14</i>	-0.124+ <i>-2.43</i>	-0.011 <i>-1.05</i>
	Hetero	-0.028* <i>2317.2</i>	-0.030* <i>140.3</i>	-0.030* <i>112.2</i>	-0.025* <i>297.8</i>	-0.039* <i>367.8</i>	-0.031* <i>149.7</i>	-0.024* <i>612.9</i>	-0.081* <i>78.4</i>	-0.025* <i>337.8</i>
12.90- 6-95	LASS	0.068* <i>35.11</i>	0.056* <i>7.51</i>	0.041* <i>6.38</i>	0.070* <i>12.61</i>	0.065* <i>11.66</i>	0.068* <i>11.19</i>	0.078* <i>23.65</i>	0.049* <i>2.77</i>	0.058* <i>13.72</i>
	LDASS	-0.087* <i>-11.16</i>	0.051+ <i>1.99</i>	0.103* <i>4.24</i>	-0.214* <i>-8.98</i>	-0.095* <i>-4.85</i>	-0.140* <i>-6.11</i>	-0.120* <i>-8.69</i>	-0.021 <i>-0.30</i>	-0.002 <i>-0.12</i>
	Hetero	-0.032* <i>1206.5</i>	-0.036* <i>79.7</i>	-0.036* <i>73.7</i>	-0.031* <i>161.8</i>	-0.042* <i>218.9</i>	-0.039* <i>109.7</i>	-0.028* <i>316.2</i>	-0.092* <i>34.0</i>	-0.029* <i>177.8</i>
6.95- 12.99	LASS	0.048* <i>53.33</i>	0.037* <i>12.26</i>	0.043* <i>10.75</i>	0.055* <i>23.45</i>	0.048* <i>15.83</i>	0.048* <i>15.37</i>	0.046* <i>34.25</i>	0.041* <i>5.24</i>	0.039* <i>20.02</i>
	LDASS	-0.179* <i>-24.42</i>	-0.048+ <i>-2.14</i>	-0.083* <i>-2.78</i>	-0.322* <i>-15.45</i>	-0.187* <i>-8.42</i>	-0.223* <i>-9.03</i>	-0.199* <i>-18.63</i>	-0.269* <i>-3.47</i>	-0.054* <i>-4.15</i>
	Hetero	-0.025* <i>964.4</i>	-0.024* <i>48.8</i>	-0.025* <i>43.7</i>	-0.019* <i>98.6</i>	-0.037* <i>148.0</i>	-0.025* <i>51.5</i>	-0.020* <i>256.2</i>	-0.057* <i>36.6</i>	-0.023* <i>129.5</i>

Notes: Table 2 shows estimated values of $\beta-1$ and $\beta-1$ (coefficients on LASS) and r and p (coefficients on LDASS) in equations [2] and [4]. White-adjusted t-statistics are shown beneath in italics. Intercept and time dummy coefficients are not reported.

'Hetero' is the estimated coefficient on the lagged squared size variable in the auxiliary regression used to obtain the heteroscedasticity LM test statistic, shown beneath in italics.

* = significant at 1% level, 2-tail test; + = significant at 5% level, 2-tail test.

Common bond categories are as defined in notes to Table 1.

Table 3 Tests of the LPE: univariate estimations, membership size measure

Dependent variable = DMEM

Estimation ↓ period		Common bond category								
		All	1	2	3	4	5	6	7	8
Cross-sectional estimations (equation [2])										
12.90- 12.99	LMEM	0.056* 15.13	0.007 0.25	0.026 1.44	0.050* 6.85	0.073* 7.03	0.091* 8.47	0.028* 5.10	0.102* 3.24	0.040* 6.45
	LDME M	-0.787* -7.53	-0.558 -1.76	-0.670* -3.18	-0.985* -18.15	-0.839* -4.53	-1.076* -15.26	-0.852* -9.80	-1.106+ -2.16	0.017 0.13
	Hetero	-0.406 3.2	-3.298 3.0	-2.202 3.7	0.611* 8.1	-0.451 0.8	-0.259 0.3	-0.411* 5.5	-1.901 1.9	-0.291 1.5
12.90- 6.95	LMEM	0.023* 7.30	-0.027 -0.95	-0.003 -0.18	0.018* 3.63	0.028* 4.09	0.041* 5.78	0.011* 2.82	0.037 1.64	0.021* 4.96
	LDME M	-0.772* -7.29	-0.518 -1.58	-0.680* -3.35	-0.963* -21.34	-0.820* -5.30	-1.019* -18.18	-0.862* -10.88	-0.839+ -2.27	-0.065 -0.54
	Hetero	-0.207 0.9	-3.003 2.3	-1.831+ 5.0	0.203 3.7	-0.587* 6.0	-0.164 1.0	-0.334* 8.1	-1.448 1.9	0.125 0.6
6.95- 12.99	LMEM	0.038* 23.33	0.039* 5.59	0.034* 4.42	0.036* 9.15	0.051* 8.49	0.055* 8.38	0.024* 8.20	0.060* 2.96	0.026* 6.88
	LDME M	-0.103 -1.13	0.096 0.47	-0.009 -0.08	-0.020 -0.19	-0.089 -0.96	-0.230 -0.77	-0.056 -0.26	-0.604+ -2.00	-0.366 -1.50
	Hetero	-0.161* 7.8	-0.152 0.9	-0.476 0.9	0.032 0.1	-0.252 1.5	-0.095 0.1	-0.132 2.6	-0.735 0.8	-0.135 1.1
Panel estimations (equation [4])										
12.90- 12.99	LMEM	-0.003 -0.46	-0.003 -0.31	-0.024 -0.94	-0.025 -0.98	0.003 0.24	-0.052 -1.29	-0.001 -0.06	-0.032 -1.10	0.011 0.86
	LDME M	-0.346* -7.33	-0.292 -1.89	-0.479* -4.14	-0.285+ -2.44	-0.318* -3.21	-0.345+ -2.20	-0.307* -3.13	-0.452* -5.28	-0.386* -3.11
	Hetero	-0.358* 81.9	-0.861* 17.0	-0.745* 27.8	-0.319* 8.4	-0.248* 5.9	-0.498 3.0	-0.343* 26.3	-0.921* 29.8	-0.290* 11.2
12.90- 6-95	LMEM	-0.074* -3.68	-0.025 -0.88	-0.086 -1.32	-0.068+ -2.15	-0.104+ -2.29	-0.072 -1.61	-0.108+ -2.37	-0.167 -1.83	-0.063 -1.37
	LDME M	-0.311* -5.84	-0.292 -1.69	-0.465* -3.09	-0.166* -2.87	-0.282+ -2.50	-0.211 -1.92	-0.270* -2.78	-0.408* -3.75	-0.377+ -2.46
	Hetero	-0.493* 52.1	-1.636* 13.6	-1.309* 23.1	-0.125* 9.9	-0.403 3.6	-0.252* 8.1	-0.564* 17.3	-1.062* 15.2	-0.473* 6.7
6.95- 12.99	LMEM	0.027* 5.95	0.012* 3.21	0.011 1.21	-0.001 -0.03	0.041* 8.50	-0.044 -0.87	0.034* 15.55	0.017 1.05	0.032* 5.26
	LDME M	-0.383* -4.35	-0.277 -1.58	-0.479* -5.58	-0.441 -1.83	-0.323* -4.94	-0.429 -1.73	-0.249* -6.16	-0.376* -3.13	-0.269* -4.52

	Hetero	-0.227*	-0.190*	-0.168	-0.461 ⁺	-0.078*	-0.640	-0.073*	-0.715*	-0.110*
		<i>22.5</i>	<i>7.3</i>	<i>3.3</i>	<i>4.5</i>	<i>5.5</i>	<i>1.2</i>	<i>40.6</i>	<i>14.6</i>	<i>26.4</i>

Notes: Table 3 shows estimated values of $b-1$ and $\beta-1$ (coefficients on LMEM) and r and ρ (coefficients on LD MEM) in equations [2] and [4]. White-adjusted t-statistics are shown beneath in italics. Intercept and time dummy coefficients are not reported.

'Hetero' is the estimated coefficient on the lagged squared size variable in the auxiliary regression used to obtain the heteroscedasticity LM test statistic, shown beneath in italics.

* = significant at 1% level, 2-tail test; ⁺ = significant at 5% level, 2-tail test.

Common bond categories are as defined in notes to Table 1.

Table 4 Multivariate estimations, full sample, assets size measure

Dependent variable = DASS

Estimation period →	Cross-sectional estimations (equation [5])			Panel estimations (equation [6])		
	12.90-12.99	12.90-6.95	6.95-12.99	12.90-12.99	12.90-6.95	6.95-12.99
LASS(S/S)	0.014* <i>3.02</i>	-0.008+ <i>-2.55</i>	0.026* <i>9.12</i>	0.001* <i>5.19</i>	-0.001* <i>-4.84</i>	0.003* <i>13.69</i>
LASS(F/S)	-0.012+ <i>-2.52</i>	-0.021* <i>-6.15</i>	0.015* <i>5.02</i>	-0.002* <i>-6.84</i>	-0.004* <i>-11.81</i>	0.001* <i>4.04</i>
LASS(S/M)	0.007 <i>0.73</i>	-0.010 <i>-1.67</i>	0.021* <i>4.14</i>	0.001 <i>1.90</i>	-0.001+ <i>-2.23</i>	0.003* <i>5.23</i>
LASS(F/M)	-0.020 <i>-1.80</i>	-0.023* <i>-3.29</i>	0.010 <i>1.60</i>	-0.002* <i>-3.84</i>	-0.004* <i>-5.62</i>	0.001 <i>0.81</i>
LDASS	0.632* <i>8.63</i>	0.159* <i>2.80</i>	0.460* <i>9.70</i>	-0.086* <i>-18.61</i>	-0.048* <i>-7.15</i>	-0.138* <i>-22.04</i>
AGE	-0.028* <i>-6.48</i>	-0.022* <i>-7.26</i>	-0.015* <i>-3.35</i>	-0.004* <i>-15.26</i>	-0.004* <i>-11.60</i>	-0.004* <i>-8.76</i>
MPOT	-0.045* <i>-6.82</i>	-0.027* <i>-6.14</i>	-0.020* <i>-5.18</i>	-0.005* <i>-16.51</i>	-0.005* <i>-11.74</i>	-0.004* <i>-11.55</i>
ROA	36.280* <i>35.04</i>	15.490* <i>29.36</i>	14.041* <i>25.85</i>	0.775* <i>32.69</i>	0.697* <i>21.79</i>	0.878* <i>23.84</i>
COST	-1.939* <i>-3.80</i>	-1.485* <i>-4.27</i>	-2.586* <i>-9.16</i>	-0.906* <i>-48.12</i>	-0.970* <i>-33.60</i>	-0.837* <i>-33.69</i>
CAP	-3.053* <i>-28.13</i>	-1.422* <i>-20.30</i>	-1.261* <i>-20.29</i>	-0.182* <i>-43.83</i>	-0.182* <i>-28.54</i>	-0.183* <i>-33.45</i>
BAD	-3.111* <i>-11.42</i>	-2.199* <i>-13.86</i>	-0.868* <i>-5.66</i>	-0.175* <i>-20.24</i>	-0.230* <i>-18.48</i>	-0.109* <i>-9.16</i>
Hetero	-0.621* <i>241.8</i>	-0.271* <i>211.9</i>	-0.248* <i>220.7</i>	-0.027* <i>2407.2</i>	-0.030* <i>1335.7</i>	-0.023* <i>1010.0</i>

Notes: Table 4 shows estimated coefficients on all variables included in equations [5] and [6] as listed in the first column. White-adjusted t-statistics are shown beneath in italics. Intercept and time dummy coefficients are not reported. Slope dummy variables are used to obtain separate estimates of β -1 and β -1 (coefficients on LASS) for state chartered single bond (S/S); federally chartered single bond (F/S); state chartered multiple bond (S/M); and federally chartered multiple bond (F/M) credit unions. 'Hetero' is the estimated coefficient on the lagged squared size variable in the auxiliary regression used to obtain the heteroscedasticity LM test statistic, shown beneath in italics.

* = significant at 1% level, 2-tail test; + = significant at 5% level, 2-tail test.

Table 5 Multivariate estimations, full sample, membership size measure

Dependent variable = DMEM

Estimation period →	Cross-sectional estimations (equation [5])			Panel estimations (equation [6])		
	12.90-12.99	12.90-6.95	6.95-12.99	12.90-12.99	12.90-6.95	6.95-12.99
LMEM(S/S)	0.031* <i>5.20</i>	0.014* <i>3.02</i>	0.024* <i>8.14</i>	0.003* <i>3.25</i>	0.002+ <i>2.20</i>	0.003* <i>2.82</i>
LMEM(F/S)	0.010 <i>1.01</i>	-0.006 <i>-0.66</i>	0.025* <i>7.51</i>	-0.002 <i>-1.53</i>	-0.008* <i>-3.68</i>	0.004* <i>6.55</i>
LMEM(S/M)	-0.007 <i>-0.41</i>	-0.017 <i>-1.18</i>	0.021* <i>3.66</i>	-0.002 <i>-1.17</i>	-0.009+ <i>-2.26</i>	0.004* <i>5.62</i>
LMEM(F/M)	-0.027 <i>-1.20</i>	-0.035 <i>-1.72</i>	0.021* <i>3.11</i>	-0.006+ <i>-2.31</i>	-0.017* <i>-3.52</i>	0.005* <i>3.66</i>
DLMEM	-0.746* <i>-7.39</i>	-0.748* <i>-7.13</i>	-0.130 <i>-1.51</i>	-0.428* <i>-9.37</i>	-0.444* <i>-8.24</i>	-0.364* <i>-4.67</i>
AGE	-0.013* <i>-2.78</i>	-0.007+ <i>-2.12</i>	-0.014* <i>-3.39</i>	-0.002* <i>-2.86</i>	-0.001 <i>-0.75</i>	-0.003* <i>-3.63</i>
MPOT	-0.020* <i>-2.60</i>	-0.020* <i>-3.22</i>	-0.010* <i>-2.71</i>	-0.006* <i>-6.04</i>	-0.006* <i>-4.72</i>	-0.006* <i>-4.91</i>
ROA	18.118* <i>20.55</i>	8.345* <i>17.23</i>	6.398* <i>12.85</i>	0.428* <i>8.86</i>	0.478* <i>7.02</i>	0.344* <i>5.17</i>
COINC	-2.412* <i>-5.14</i>	-1.598* <i>-4.76</i>	-1.321* <i>-4.61</i>	-0.331* <i>-9.77</i>	-0.333* <i>-5.67</i>	-0.339* <i>-8.63</i>
CAP	-2.046* <i>-20.42</i>	-1.041* <i>-14.10</i>	-0.790* <i>-13.48</i>	-0.122* <i>-12.19</i>	-0.153* <i>-8.61</i>	-0.091* <i>-8.80</i>
BAD	-1.652* <i>-6.23</i>	-1.190* <i>-7.97</i>	-0.323 <i>-1.75</i>	-0.133* <i>-6.36</i>	-0.202* <i>-6.14</i>	-0.056+ <i>-2.19</i>
Hetero	-0.294 <i>2.1</i>	-0.151 <i>0.5</i>	-0.149* <i>7.7</i>	-0.406* <i>87.0</i>	-0.601* <i>60.6</i>	-0.205* <i>23.4</i>

Notes: Table 5 shows estimated coefficients on all variables included in equations [5] and [6] as listed in the first column. White-adjusted t-statistics are shown beneath in italics. Intercept and time dummy coefficients are not reported. Slope dummy variables are used to obtain separate estimates of β_1 and β_2 (coefficients on LMEM) for state chartered single bond (S/S); federally chartered single bond (F/S); state chartered multiple bond (S/M); and federally chartered multiple bond (F/M) credit unions. 'Hetero' is the estimated coefficient on the lagged squared size variable in the auxiliary regression used to obtain the heteroscedasticity LM test statistic, shown beneath in italics.

- = significant at 1% level, 2-tail test; + = significant at 5% level, 2-tail test.

Table 6 Multivariate panel estimations (equation [6]), sample disaggregated by common bond category

	Dependent variable = DLASS								Dependent variable = DLMEM							
	Common bond category								Common bond category							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
LASS or LMEM (S)	-0.002* <i>-2.71</i>	0.000 <i>0.63</i>	0.003* <i>6.51</i>	0.001 <i>1.26</i>	-0.002+ <i>-2.26</i>	0.001+ <i>2.46</i>	-0.032* <i>-3.74</i>	0.000 <i>0.61</i>	0.000 <i>0.24</i>	0.000 <i>-0.07</i>	0.001 <i>0.57</i>	0.003* <i>2.80</i>	-0.001 <i>-0.17</i>	0.003* <i>4.29</i>	-0.045+ <i>-2.52</i>	0.002* <i>2.86</i>
LASS or LMEM (F)	-0.004* <i>-5.43</i>	0.000 <i>-0.22</i>	-0.003* <i>-5.53</i>	-0.003* <i>-6.22</i>	-0.003* <i>-4.64</i>	-0.001* <i>-5.45</i>	-0.006* <i>-3.62</i>	-0.001 <i>-1.82</i>	-0.009 <i>-1.35</i>	-0.007 <i>-1.20</i>	-0.002 <i>-0.78</i>	-0.001 <i>-0.29</i>	0.000 <i>-0.08</i>	-0.002 <i>-1.61</i>	-0.003 <i>-0.70</i>	-0.001 <i>-0.23</i>
LDASS or LDMEM	0.041* <i>2.92</i>	0.038+ <i>2.33</i>	-0.226* <i>-16.0</i>	-0.117* <i>-9.45</i>	-0.140* <i>-9.78</i>	-0.093* <i>-12.9</i>	-0.109+ <i>-2.46</i>	0.007 <i>0.73</i>	-0.386* <i>-2.60</i>	-0.520* <i>-5.11</i>	-0.455* <i>-3.49</i>	-0.402* <i>-3.85</i>	-0.459* <i>-2.87</i>	-0.407* <i>-4.43</i>	-0.471* <i>-5.79</i>	-0.370* <i>-3.19</i>
AGE	-0.003+ <i>-2.29</i>	0.000 <i>0.10</i>	-0.005* <i>-6.53</i>	-0.004* <i>-5.00</i>	-0.006* <i>-5.91</i>	-0.004* <i>-9.81</i>	-0.009* <i>-2.77</i>	-0.005* <i>-7.36</i>	-0.001 <i>-0.33</i>	0.003 <i>0.81</i>	-0.002 <i>-1.62</i>	-0.003+ <i>-2.51</i>	-0.003 <i>-1.14</i>	-0.002+ <i>-2.10</i>	0.004 <i>0.58</i>	-0.001 <i>-0.97</i>
MPOT	-0.002+ <i>-2.51</i>	-0.002 <i>-1.57</i>	-0.006* <i>-6.65</i>	-0.006* <i>-5.39</i>	-0.007* <i>-4.72</i>	-0.004* <i>-6.48</i>	-0.005+ <i>-2.22</i>	-0.003* <i>-6.00</i>	0.000 <i>-0.18</i>	-0.003 <i>-1.10</i>	-0.013* <i>-2.66</i>	-0.009* <i>-3.20</i>	-0.024+ <i>-2.49</i>	-0.005* <i>-2.75</i>	-0.004 <i>-1.03</i>	-0.004* <i>-3.17</i>
ROA	0.956* <i>9.41</i>	0.417* <i>5.32</i>	0.686* <i>12.1</i>	0.472* <i>8.67</i>	0.661* <i>8.18</i>	1.163* <i>25.4</i>	0.626* <i>3.53</i>	0.767* <i>13.2</i>	0.307 <i>1.14</i>	0.081 <i>0.44</i>	0.370* <i>4.83</i>	0.464* <i>3.94</i>	0.286+ <i>2.22</i>	0.533* <i>4.95</i>	0.684+ <i>2.08</i>	0.390* <i>4.48</i>
COINC	-1.183* <i>-13.9</i>	-1.018* <i>-16.3</i>	-0.961* <i>-17.8</i>	-1.331* <i>-20.9</i>	-1.119* <i>-19.2</i>	-0.831* <i>-25.9</i>	-1.090* <i>-6.91</i>	-0.814* <i>-19.2</i>	-0.811* <i>-4.84</i>	-0.488* <i>-3.51</i>	-0.227* <i>-2.71</i>	-0.402* <i>-4.41</i>	-0.429* <i>-3.86</i>	-0.306* <i>-4.18</i>	0.080 <i>0.25</i>	-0.423* <i>-5.61</i>
CAP	-0.209* <i>-11.9</i>	-0.133* <i>-8.95</i>	-0.152* <i>-13.9</i>	-0.134* <i>-14.2</i>	-0.179* <i>-13.9</i>	-0.203* <i>-26.3</i>	-0.355* <i>-7.46</i>	-0.181* <i>-19.0</i>	-0.169* <i>-4.34</i>	-0.136* <i>-3.22</i>	-0.090* <i>-4.21</i>	-0.114* <i>-5.97</i>	-0.089* <i>-3.54</i>	-0.112* <i>-5.10</i>	-0.261+ <i>-2.38</i>	-0.105* <i>-6.34</i>
BAD	-0.234* <i>-6.55</i>	-0.095* <i>-4.96</i>	-0.166* <i>-6.69</i>	-0.227* <i>-10.7</i>	-0.152* <i>-4.93</i>	-0.213* <i>-10.9</i>	-0.226* <i>-4.25</i>	-0.141* <i>-6.68</i>	-0.168 <i>-1.85</i>	-0.089 <i>-1.49</i>	-0.118* <i>-2.69</i>	-0.178* <i>-5.37</i>	-0.082 <i>-1.41</i>	-0.136+ <i>-2.10</i>	-0.236+ <i>-2.30</i>	-0.092+ <i>-2.16</i>
Hetero	-0.028* <i>142</i>	-0.028* <i>112</i>	-0.024* <i>342</i>	-0.034* <i>341</i>	-0.029* <i>149</i>	-0.023* <i>652</i>	-0.077* <i>93.0</i>	-0.025* <i>340</i>	-0.988* <i>21.7</i>	-0.829* <i>33.0</i>	-0.402* <i>13.9</i>	-0.333* <i>10.5</i>	-0.589+ <i>4.5</i>	-0.430* <i>24.0</i>	-1.005* <i>22.7</i>	-0.284* <i>12.0</i>

Notes: Table 6 shows estimated coefficients on all variables included in equation [6] as listed in the first column. White-adjusted t-statistics are shown beneath in italics. Intercept and time dummy coefficients are not reported. Slope dummy variables are used to obtain separate estimates of $\beta-1$ and $\beta-1$ (coefficients on LASS and LMEM) for state (S)

and federally chartered (F) credit unions.

'Hetero' is the estimated coefficient on the lagged squared size variable in the auxiliary regression used to obtain the heteroscedasticity LM test statistic, shown beneath in italics. * = significant at 1% level, 2-tail test; + = significant at 5% level, 2-tail test.

Table 7 Multivariate panel estimations (equation [6]), alternative samples.

Sample →	Dep var = DLASS			Dep var = DLMEM		
	Non-merging survivors	Merging survivors	Incomplete data	Non-merging survivors	Merging survivors	Incomplete data
LASS or LMEM(S/S)	0.003* 3.25	-0.000 -0.32	-0.025+ -2.53	0.031* 5.20	0.001 0.71	-0.008 -1.74
LASS or LMEM(F/S)	-0.002 -1.53	-0.002+ -2.05	-0.064* -3.29	0.010 1.01	-0.002 -0.80	-0.030* -3.15
LASS or LMEM(S/M)	-0.002 -1.17	-0.001 -0.47	-0.045 -1.15	-0.007 -0.41	-0.003 -0.69	-0.013 -0.63
LASS or LMEM(F/M)	-0.006+ -2.31	-0.003 -1.03	-0.082 -1.66	-0.027 -1.20	-0.006 -1.13	-0.033 -1.27
DLASS or DLMEM	-0.428* -9.37	0.009 0.48	-0.468* -4.21	-0.746* -7.39	-0.225+ -2.51	-0.488+ -5.15
AGE	-0.002* -2.86	-0.021 -1.84	0.061* 2.98	-0.013* -2.78	-0.015 -0.84	0.012 1.18
MPOT	-0.006* -6.04	-0.040* -2.95	0.060+ 2.11	-0.020* -2.60	-0.036 -1.73	-0.105* -3.78
ROA	0.428* 8.86	0.781* 4.34	0.916* 2.65	18.118* 20.55	0.261 1.05	1.049+ 2.11
COINC	-0.331* -9.77	-1.001* -6.92	-1.363* -4.64	-2.412* -5.14	-0.566* -2.33	0.480+ 2.23
CAP	-0.122* -12.19	-0.257* -7.18	-0.412* -5.13	-2.046* -20.42	-0.196* -2.78	-0.258* -4.54
BAD	-0.133* -6.36	-0.203* -3.09	-0.277* -3.29	-1.652* -6.23	-0.314 -0.64	-0.056 -1.23
Hetero	-0.406* 87.0	-0.017* 9.5	-2.762* 98.2	-0.294 2.1	-0.117 10.8	-1.594* 40.0
No. of credit unions	7,603	184	1,059	7,603	184	1,059
No. of panel observations	136,854	3,312	10,658	136,854	3,312	10,658

Notes: Table 7 shows estimated coefficients on all variables included in equation [6] as listed in the first column. White-adjusted t-statistics are shown beneath in italics. Intercept and time dummy coefficients are not reported. Slope dummy variables are used to obtain separate estimates of $\beta-1$ and $\beta-1$ (coefficients on LASS) for state chartered single bond (S/S); federally chartered single bond (F/S); state chartered multiple bond (S/M); and federally chartered multiple bond (F/M) credit unions. 'Hetero' is the estimated coefficient on the lagged squared size variable in the auxiliary regression used to obtain the heteroscedasticity LM test statistic, shown beneath in italics.

* = significant at 1% level, 2-tail test; + = significant at 5% level, 2-tail test.