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Capital Management in Mutual Financial Institutions

Christine Brown,
Department of Finance, The University of Melbourne

and

Kevin Davis,
Department of Finance, The University of Melbourne
and the Melbourne Centre for Financial Studies[*]

Victoria 3010
Australia

christine.brown@unimelb.edu.au
kevin.davis@unimelb.edu.au

Ph: 61 3 8344 5308
61 3 8344 5908
Fax: 61 3 8344 6914

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Capital Management in Mutual Financial Institutions

ABSTRACT

Capital management by mutual financial institutions (such as credit unions) provides a valuable testing ground for assessing the impact of capital regulation and theories of managerial behaviour in financial institutions. Limited access to external equity capital means that capital accumulation must be met primarily by reliance on retained earnings. To deal with shocks to the capital position and avoid breaching regulatory requirements, managers will aim to have a buffer of capital in excess of the regulatory minimum. Moreover, mutual governance arrangements and an absence of capital market discipline mean that managers have discretion to set target capital ratios which differ significantly from industry averages. This paper develops a formal model of capital management and risk management in mutual financial institutions such as credit unions which reflects these industry characteristics. The model is tested using data from larger credit unions in Australia, which have been subject to the Basel Accord Risk Weighted Capital Requirements since 1993. The data supports the hypothesis that credit unions manage their capital position by setting a short term target profit rate (return on assets) which is positively related to asset growth and which is aimed at gradually removing discrepancies between the actual and desired capital ratio. Desired capital ratios vary significantly across credit unions. There is little evidence of short run adjustments to the risk of the asset portfolio to achieve a desired capital position.

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Introduction

In recent decades, widespread application of minimum capital requirements to mutual financial institutions[1] has made capital management a particularly important issue for such institutions. However, unlike the case of banking, there has been little research on capital management in financial mutuals (such as credit unions), even though mutuality creates particular complications for the capital management process for several reasons.

These reasons include the following. First, mutuals have no, or little, access to external equity capital and must rely on retained earnings (internally generated funds) as the source of capital accumulation. Second, management autonomy in mutuals may result in risk averse managers choosing excessively high target capital ratios ((Deshmukh, Greenbaum and Thakor, 1982). Third, there is no equity market pressure for convergence towards some common (or optimal) capital ratio. Fourth, acquisition of capital imposes a cost on current member owner-customers in the form of the increased interest spread (between loans and deposits) and fees needed to generate profits. Consequently, management's ability to actively manage the capital accumulation process may depend upon the mutual's degree of market power in deposit and/or loan markets (arising from member loyalty or switching costs).

In this paper we develop and test, using data on Australian credit unions, an explicit model of capital management in mutual financial institutions. We are able to address the important question of whether agency problems and lack of equity market discipline, leading to managerial autonomy in mutuals and resulting risk averse behaviour (Rasmusen, 1988), also extends to choice of capital buffer (consistent with the analysis of Deshmukh *et al*) such that mutuals exhibit disparate target capital ratios, and find some evidence that this is the case. We also find evidence that Australian credit unions have some degree of market power which enables them to adjust target profit rates in order to alter the speed of capital accumulation. We are able to examine whether risk based capital requirements lead to risk and capital management being interrelated, and find no evidence to support this hypothesis in the case of Australian credit unions.

[1] Application of minimum capital adequacy requirements (in some cases risk based), typically based on a premise that owners funds should provide an adequate risk buffer to protect depositors against loss, has occurred despite the fact that there is no distinction between owners and depositors in mutual organisations.

Our analysis makes several additional contributions. First, the model of capital and risk management developed in the paper provides a clear formulation of the nature of interrelationships between risk and capital management and the nature of the partial adjustment mechanism involved. It leads to a novel approach to examining capital management particularly applicable for mutuals which focuses upon modelling of profitability.

Second, unlike many earlier studies, we use panel data estimation techniques which enable us to capture both cross sectional differences and intertemporal influences upon capital management behaviour.

Third, by controlling for access to external equity markets (because there is none for these institutions) our results may assist in interpreting results of bank capital management studies. Those studies have interpreted an observed relationship between size and capital management behaviour as suggesting that limited access to equity markets for smaller banks may affect capital management behaviour. An absence of a size effect in the case of mutuals would lend support to that interpretation of size as a proxy for differential access to external equity (rather than reflecting other factors) in bank capital management studies.

The paper proceeds as follows. Section 1 provides a brief outline of the key characteristics of mutual financial institutions relevant to capital management, and introduces our main hypotheses. In Section 2 we briefly review the limited number of primarily theoretical prior studies of capital management behaviour in credit unions. Section 3 then reviews previous empirical studies of bank capital management under regulation. It provides the background to the analytical model of capital management in mutuals, which is developed in Section 4. Section 5 provides relevant background information on the Credit Union sector in Australia to provide context for our empirical work and describes the data used. Section 6 discusses equation specification and estimation techniques and results of the analysis are reported and discussed in Section 7. Section 8 presents conclusions, including suggestions for further research.

1. Mutual Financial Institutions, Governance and Capital Management

Credit Unions are a relatively simple type of mutual financial institution whose primary business activities are providing savings facilities (and associated payments services) and lending to individuals who are member/owners of the organization.[2] Fundamental characteristics include a not-for-profit objective, one-member-one-vote governance, and membership restricted to individuals satisfying a common bond requirement. Membership requires purchase of an equity share which is for a purely nominal amount, is withdrawable, non transferable, and does not provide permanent share capital[3]. Accumulated surpluses (profits) form the non-withdrawable capital base of the organization, such that capital evolves over time according to:

$$E_{t+1} = \rho_{t,t+1} A_t + E_t \tag{1}$$

where: E_t is capital at time t, A_t is assets at time t, and $\rho_{t,t+1}$ is the rate of return over the period $(t, t+1)$ on initial (date t) assets.[4] Assets (A_t) consist primarily of loans to members and liquid assets, and are financed by capital (E_t) and member deposits (D_t).

Such mutual organisations are potentially subject to significant management-stakeholder agency problems (although depositor-owner conflicts are absent because of the mutual structure). Management entrenchment and autonomy may lead to pursuit of growth, profit orientation and accumulation of surpluses, even if these are not necessarily in the best interests of current member-owners. Achieving a larger surplus and accumulating capital involves operating with a larger spread between lending and deposit interest rates (or imposition of higher fees) than might otherwise be chosen. This is a cost to current members who bear that spread in their transactions with the mutual, and have no marketable claim on the resulting accumulated (retained) surpluses (unless the organization is wound up or demutualised). Risk averse, entrenched, managers who, for example, choose to operate with a higher target capital/assets ratio must (for a given asset growth rate) generate a higher return on assets to achieve and maintain that ratio (as explained below).

Regulation may reinforce some of these tendencies. In particular, imposition of minimum capital requirements can be expected to affect management "profit"

[2] Although credit unions are typically relatively small organisations and a small part of the financial sector, they have significant membership (over 20 percent of the economically active population in Australia and Canada and over 40 per cent in the USA).
[3] Because of these features and its trivial size this source of equity capital is ignored in the subsequent discussion and analysis.
[4] Equation (1) can also be defined using rate of return measured on average assets over the period (t,t+1) and this measure is used in our empirical work.

targets, both in the short term and in the longer term. In the short term, to increase the capital/asset ratio $k_t = \left(\frac{E}{A}\right)_t$, the return on assets ρ must exceed $g.k_t$ where g is the growth rate of assets, as can be seen by using equation (1) to note that:

$$\Delta k_{t,t+1} = \Delta\left(\frac{E}{A}\right)_{t,t+1} = \frac{E_{t+1}}{A_{t+1}} - \frac{E_t}{A_t} = \frac{\rho_{t,t+1}}{1+g} - \frac{g}{1+g}\left(\frac{E}{A}\right)_t = \frac{\rho_{t,t+1}}{1+g} - \frac{g}{1+g}k_t \qquad (2)$$

In the longer term, inability to raise external capital means that maintenance of a long run target for k of k* (such that $\Delta k_{t,t+1} = 0$) implies a long run target for ρ of:

$$\rho^* = gk^* . \qquad (3)$$

Equation (3) suggests that a credit union which is at its optimal capital ratio and not growing (g = 0), will maximize current member wealth by having a target profit rate (ρ) of zero. As Davis (2007) argues, current members will prefer current benefits (in the form of better interest rates on transactions with the credit union) to a higher profit, because their property rights over the communally owned retained earnings arising from higher profits are unclear. A growing credit union, or one with a capital shortfall, will target a positive profit rate, in order to maintain or to move closer to the optimal capital ratio. That optimal capital ratio will involve a trade-off between members' preferences between increased safety of deposits (from a higher capital buffer) and their perceived private cost of having higher communal wealth (to which they have incomplete property rights) rather than those funds distributed as private wealth.

One possible consequence of this trade-off is that credit unions with tight common bonds, where members place a high value on communal wealth, may have higher target capital ratios. Although the large Australian credit unions we examine generally have quite broad common bonds, we consider whether common bond type appears to influence capital management behaviour in section 6.

An increase in the target capital ratio induced by regulation would (given constant growth) lead to a long run increase in the target return on assets. Achieving this requires the mutual to have some short run market power, or accept a lower rate of growth. If profitability can be increased to achieve a higher capital ratio, the higher return on assets can be achieved at an unchanged rate of return on equity – and thus does not require the existence of longer-run market power. Thus, while in the short term, an increase in the capital ratio also requires an increase in the return on equity (ρ / k), a constant long run target capital ratio implies a target long run return on equity equal the growth rate of assets g.

Where capital requirements are based on risk weighted assets (as in Australia), an incentive may exist to shift the composition of lending into lower risk weighted assets to reduce the implicit costs on current members associated with capital accumulation by mutuals. Thus, if m is the average risk weight of assets such that the risk weighted capital ratio (CAR) is $\left(\frac{k}{m}\right)$, a reduction in m increases CAR for a given capital asset ratio k.

These interrelationships between changes in capital ratios and profitability are fundamental to the modelling of capital management in mutual financial institutions undertaken in Section 4, and used to examine several hypotheses implied by the preceding discussion.

Those hypotheses are as follows. First, managerial autonomy and lack of equity market discipline suggest that long run target capital ratios may vary markedly between mutuals (and may depend upon factors such as characteristics of the membership base, management tenure, or local financial market conditions). Second, as implied by equation (2), the speed of adjustment of the capital ratio is positively related to the profit rate (for a given asset growth rate). We test the proposition that credit unions have some degree of short term market power (due to member loyalty or switching costs) which enables them to adjust loan and deposit interest rates (and fees) and thus profitability, in order to actively manage their capital position. Third, with no access to external capital, we investigate whether credit unions actively manage the composition of asset portfolios to adjust the average risk weight to meet risk based capital requirement. Fourth, we hypothesise that managers will be hesitant to impose excessive costs on current members in order to achieve a higher return on assets. As a result, an increase in the growth rate would lead to a less than equivalent increase in the target return on assets as is required to keep the target capital ratio constant. Thus we anticipate a negative longer term relationship between growth and the desired capital ratio.

2. Prior Studies of Credit Union Capital Management

There have been few analyses of mutual or credit union capital management behaviour which have adopted a dynamic approach reflecting the constraint imposed by mutuality. Deshmukh *et al* note that capital reserves reduce the risk faced by uninsured depositors in mutuals.[5] Members of mutuals, such as credit unions, thus receive benefits of retained surpluses accrued at the expense of past members, and incur the cost of the mutual making a current surplus which is retained for the benefit of future members. In their model, management has an incentive to accumulate capital because of the protection this affords to the continued survival of the organisation and thus to the stream of quasi-rents which management is able to receive in the form of above normal salary or perquisites.

One consequence of their analysis is that a positive relationship between profit rates and capital position would be expected if there is no deposit insurance and if members perceive higher capital as providing greater safety for deposits. This arises because better capitalised mutuals use less deposits (relative to accumulated retained earnings) to finance a given size asset portfolio and can offer lower deposit interest rates (due to their perceived greater safety), with both factors leading to a higher expected profit rate as measured by the accounting return on assets.

This hypothesis of a positive effect of the capital ratio on profitability is at variance with the notion that credit unions adjust profit rates to move towards a target capital ratio, which leads to an expectation of a negative relationship. In this perspective, if all credit unions have equal target capital ratios (and face the same asset growth rates), high (low) capitalised credit unions will aim for lower (higher) profit rates to move towards their long run capital ratio targets.

There are two complications arising in attempting to discriminate between these alternative hypotheses. First, if growth rates differ, credit unions with higher (lower) growth rates will (ceteris paribus) aim for higher (lower) profit rates to maintain capital ratios at the desired level. This is implicit in the argument of Jefferson and Spencer (1988) who argue that British credit unions, assumed to have an objective of meeting a regulatory minimum capital requirement, could be expected to reduce interest rates paid on savings in periods when savings growth was high. Hence it is necessary to control

[5] There was no deposit insurance in Australia over the period studied in this paper.

for differences in credit union growth rates in analysing the relationship between profit rates and the capital position.

Second, managerial autonomy and lack of capital market discipline leads to the possibility that target capital ratios of individual credit union managers may vary widely. Indeed, the analysis of Deshmukh *et al* suggests that managers have incentives to accumulate capital continually irrespective of the preferences of owner-members. It is thus desirable to see whether there is any evidence of some constraints on managerial autonomy (or exercise thereof) in the form of behaviour consistent with a target capital ratio, albeit one which might vary across credit unions. This issue assumes particular relevance in the light of the analysis by Davis (2001) who uses an overlapping-generations model of a credit union to demonstrate that capital accumulation canlead to incentives for members to vote for demutualization even if the credit union mutual form is socially preferable (in terms of economic efficiency) to the joint-stock company alternative.

Early theoretical research on capital management in credit unions includes the model of Taylor (1971) which focuses upon interest rate setting and cost minimization and treats capital accumulation essentially as a residual. Spencer (1996) provides an extension to Taylor's work which corrects for the under-prediction of reserves (capital) and their benefits for future members that is implicit in Taylor's model. Spencer's model however assumes an exogenously determined, constant, reserve ratio and full adjustment to the desired level of reserves in the face of exogenous shocks. Jefferson and Spencer (1988) demonstrate how maintenance of a constant desired reserve (capital) ratio by UK credit unions implies that an exogenous increase in savings (deposits) requires a cut in dividend rates (deposit interest rates) if average asset yields and average operating costs are constant. This is consistent with the long run equilibrium condition given in equation (3), but does not address the optimal adjustment path for capital following a change in the growth rate of the credit union.

Smith (1988) develops a model in which credit unions set loan and deposit interest rates to maximize expected benefits to current members, subject to a "value at risk" type constraint arising from randomness in loan losses, operating costs and market interest rates (received on liquid assets). By imposing a minimum probability constraint that profits (and thus capital accumulation) do not fall below some specified level, a tradeoff between providing benefits to current members and accumulation of capital reserves is introduced. While this is not an explicit model of capital management, it leads to the predictions that credit unions with higher capital ratios, lower growth rates, less variance in the stochastic environment in which they operate, and less risk averse management would tend to set loan and deposit interest rates such that they operate with lower levels of current profitability. Our empirical results provide a test (and confirmation of the first two predictions).

Greinke (2005) examined the impact of the 1992 imposition of a minimum capital ratio on Australian credit union capital management behaviour, using a time series intervention model to examine changes in return on assets and on asset portfolio composition. His study uses data for 150 credit unions (from the state of NSW) over the period 1987 to 1997. The time period thus overlaps ours, but his sample of mostly small credit unions has only around ten per cent of credit unions in common with our Australia-wide sample of larger credit unions.

Greinke does not study optimal capital management behaviour *per se*, but uses a dummy variable approach to examine whether for each credit union the return on assets was higher, and the asset composition changed towards lower risk weight assets, for the period after the introduction of the risk weighted capital requirement. He finds mixed results with more cases where the return on assets fell than rose after the regulatory change. When the dummy coefficients are regressed (cross-sectionally) on the risk weighted capital ratio (and other variables including credit union bond type) he finds a negative coefficient, indicating that credit unions with low (high) capital ratios were more likely to increase (decrease) their return on assets. While he argues that credit union bond type is relevant for explaining capital behaviour, its statistical significance is (at best) marginal. Grienke's cross section regressions also find that those credit unions which had more substantial shifts into low risk weighted housing loans[6] were more likely to have experienced a fall in return on assets after the regulatory change.

Grienke's results suggest a linkage between capital ratios and profitability, which our theoretical modelling in section 4 makes explicit, and which our empirical work in section 6 examines in more detail using dynamic panel data estimation techniques to study the relevant adjustment processes. His suggestion that credit union

[6] These were those credit unions with larger coefficients on a time trend variable in a regression explaining the percentage of assets in housing loans (for the period after the regulatory change.

bond type may be relevant for capital management is something we also consider in section 6.

3. Prior Studies of Bank Capital Management

Bank capital management has been the subject of intensive empirical research in recent years. One objective of that research has been to determine whether risk based capital requirements lead to interrelationships between capital and risk management (Beatty and Gron 2001; Jacques and Nigro 1997; Rime 2001; Shrieves and Dahl 1992; Stolz, Heid and Porath 2003; Van Roy 2003)). Another objective has been to determine how regulatory pressure affects bank capital management (Aggarwal and Jacques 2001). Other studies (Furfine 2001), have focused on whether capital requirements have affected bank lending, while Berger (1995) examines the link between capital and return on equity.

Many recent empirical studies of financial institution capital management have followed the approach introduced to the literature by Shrieves and Dahl (1992). They adopted a partial adjustment framework in which banks adjust gradually towards long run target (optimum) capital and risk positions, but in which current capital and risk positions are also subject to exogenous disturbances. An important innovation in this approach was the recognition that the adjustment processes for capital and risk positions could be interrelated, although no theoretical justification for the precise form of interrelationship specified was provided.

Shrieves and Dahl included two separate risk measures in their study, in the form of the average risk weight of assets (as measured using the Basel Accord weights) and a loan quality variable. Subsequent studies have tended to use only one risk measure and generally focus on the first of these risk measures. Such models thus take the form:

$$\Delta CAP_t = \alpha(CAP^* - CAP_{t-1}) + u_t$$

$$\Delta Risk_t = \beta(Risk^* - Risk_{t-1}) + v_t$$

where the desired values of capital (CAP*) and risk (Risk*) are argued to be functions of variables such as bank size, profitability, regulatory pressure. To allow for interdependence of adjustment, Shrieves and Dahl and later authors also include the contemporaneous change in risk level as a determinant of the desired capital position (and vice versa) thus introducing simultaneity into the model. The random variables

(u_t and v_t) represent the exogenous shocks to capital and risk positions respectively, and some subsequent studies note that these shocks could be contemporaneously correlated (thus suggesting use of an estimation technique such as three stage least squares).

Other studies which have adopted the same approach include (Jacques and Nigro 1997; Aggarwal and Jacques 2001; Rime 2001; Van Roy 2003; and Stolz, Heid and Porath 2003).[7] Many of these later studies use the risk weighted capital ratio as the measure of the capital position, whereas Shrieves and Dahl used an unweighted capital ratio. Most use the average risk weight (based on regulatory risk weights and calculated as risk weighted assets/total assets) as a measure of risk.

Results from these studies have been mixed, although a common finding is that of quite slow adjustment of capital ratios towards long run equilibrium. There is also some evidence of effectiveness of regulatory pressure leading to more rapid increase in capital ratios for poorly capitalised banks.

The simultaneous equation approach allows the interdependence of the risk and capital decisions to be modelled, and a number of plausible arguments can be offered for the conflicting findings of positive or negative relationship between changes in risk and changes in capital. Rime (2001) notes that banks that are bounded by the regulatory capital requirements will increase capital when risk increases, so as to keep the risk-weighted capital ratio constant. Beatty and Gron (2001, p11) argue that a positive relationship is expected between changes in capital and changes in risk 'because equity financing and portfolio rebalancing are substitute activities'. Shrieves and Dahl (1992) report a negative correlation between levels of capital and risk and a positive correlation between first differences. Beatty and Gron (2001) and Rime (2001) find a positive relationship between first differences.[8] Jacques and Nigro (1997) argue that a negative relationship between adjustments may be observed if the risk-based capital standards are flawed or if deposit insurance is mispriced. Jacques

[7] Similar approaches have been used in the case of insurance by Cummins and Sommer (1996), Baranoff and Sager (2002) and Harrington and Niehaus (2002).

[8] Beatty and Gron's (2001) study uses approximately 280 banks with quarterly observations over 1986-1995. Rime (2001) has a dataset consisting of 159 Swiss banks with annual observations over 1989-1995.

and Nigro (1997), Van Roy (2003) and Stolz, Heid and Porath (2003) find adjustments in risk and capital to be negatively related.[9]

Several recent studies have focused on alternative banking systems where the issue of access to capital is potentially important. Rime (2001) considers Swiss banks where many smaller banks may not have good access to external equity markets. Stolz, Heid and Porath (2003) focus on German savings banks which have no access to external equity because of their mutual structure, and argue that their capital and risk management activities will be aimed at achieving the desired size of capital buffer above the regulatory minimum. They do not, however, focus on differences between institutions on the desired size of capital buffer.

The partial adjustment models used to explore capital management in banks are generally unable to distinguish between changes due to internally generated and externally raised capital. In this respect, the paper by Stolz et al which tests the partial adjustment model using data on German savings banks which are forbidden from raising equity capital via the capital markets, is most closely aligned with our study. For the whole sample (approximately 340 banks over 1993-2002) they find a significant negative relationship between changes in capital and changes in risk. However this result is driven by banks with a low capital buffer, whose aim is to rebuild the buffer. For banks with a high capital buffer the relationship between changes in capital and changes in risk is positive but insignificant.

Ayuso, Perez and Saurina (2004) also study the capital buffer. Using a sample of Spanish banks their primary objective is to investigate the effect of the business cycle on capital buffers. Controlling for risk (measured ex-post as non-performing loans), size of the institution and cost of servicing equity capital they find a robust and significant negative relationship between the size of the buffer and the business cycle. They also find a negative and significant relationship between non-performing loans and the size of the capital buffer.

Using an approach related to the partial adjustment models, Furfine (2001) develops a dynamic structural model of the banking firm, where the costs are related

[9] Jacques and Nigro (1997) have a two year dataset with annual observations on 2570 US commercial banks with assets in excess of $100m. VanRoy (2003) uses 586 banks with assets greater than USD100m from G10 countries Canada, France, Italy, Japan, Sweden, UK and US. The data consist of annual observations over 1988-1995. Stolz et al (2003) use annual observations of 550 German savings banks over 1994-2002.

to the size of the capital buffer and to the intensity of regulatory monitoring. Although the capital adjustment process is not modelled directly, his results do suggest that regulatory standards and monitoring have a significant effect on bank portfolio allocations.

Several papers have undertaken comparative analyses of capital management in mutuals and stock companies. Gambacorta and Mistrulli (2004) compare the impact of varying capital positions on lending behaviour of various types of Italian financial institutions. Credit cooperatives have higher capital ratios and greater volatility of that ratio than other types of depository institutions. They find a greater effect of excess capital on lending for credit cooperatives which, they argue, reflects their higher capital adjustment costs resulting from mutuality.

Harrington and Niehaus (2002) compare capital structure decisions of mutuals and stock companies in the insurance industry. They note that adjusting capital ratios is more costly for mutuals, since lack of access to external capital means that it may require actions to adjust the denominator (business scale or risk) of the ratio. Consequently, they argue that mutuals would be expected to have higher capital ratios, have slower adjustment towards target ratios, and show more sensitivity of capital ratios to income changes. Using panel data on US insurers for the 1990s, they find results consistent with these hypotheses.

The limited work, surveyed above, on capital management in mutual financial organisations suggests that there are potentially significant differences in behaviour to that of joint stock firms. With the exception of Deshmukh *et al* there has, however, been little attempt at developing a formal, theoretical, model of capital management by mutuals. That is the objective of the next section which adopts a cost of adjustment model related to those of Beatty and Gron (2001) and Furfine (2001) but imposing the constraint of mutuality that capital adjustment can only occur via retained profits.

4. A Model of Capital Management in Credit Unions

In this section we develop a model of credit union capital management reflecting the constraint imposed on capital accumulation by mutuality and reflected in equation (1). As shown previously, this leads to an interrelationship between a long run profit rate (return on assets) target (ρ*) and a long run target (non-risk weighted) capital ratio k* given in equation (3). In practice in Australia, much attention is paid also to the risk-weighted capital ratio (CAR), given its regulatory importance. CAR, k and the average risk weight of assets, *m,* are related by CAR = k/m so that CAR* = k*/ m*. Thus credit union long term objectives (including implicitly those for CAR) can be described in terms of ρ*, m* and k*, and credit union decision making in terms of the corresponding short term (annual) targets for those variables.

We assume that at each decision date (t), the Credit Union faces an anticipated asset growth rate of g_t over (t,t+1) and inherits a current average risk weight of m_t, capital ratio of k_t and profit rate (for the period just completed) of $\rho_{t-1,t}$ as the outcome of past decisions. It makes decisions at t, regarding short term targets for m_{t+1}, k_{t+1} and $\rho_{t,t+1}$ aimed at minimizing the sum of costs of disequilibrium (deviations from long run targets) and cost of adjustment.

Because of the capital accumulation constraint shown in equation (2), k_{t+1} and $\rho_{t,t+1}$ are not independent and we model credit union decision making in terms of a target profit rate (ρ) which implies (given g_t and k_t) a target for k_{t+1}. In practice, credit union management makes decisions about variables such as deposit and loan interest rates with the objective of achieving a desired profit outcome. Those decisions (together with market competition) also ultimately affect the growth rate of the credit union such that longer run equilibrium involves joint determination of profit rate, growth and capital ratios as functions, inter alia, of market competition, demand and cost factors.

In the interests of parsimonious modelling, we sidestep these complications in two ways. First, we assume that credit union management involves choosing a target return on assets (profit rate) rather than modelling the interest rate setting process designed to achieve that target return on assets. We implicitly assume (and ultimately test) that the credit union has some degree of short run market power in dealing with its members. Consequently, actual profit rates measure the targeted, expected, rates with error because of various unforseen shocks. Second, we assume that short term credit union growth is independent of the target return on assets. A more complete model would make growth endogenous (at the cost of increased complexity) but we rationalize our assumption by noting that a degree of market power for individual credit unions may create significant lags in the effect of profit target decisions on growth rates. In our empirical work we use instruments for the growth rate to overcome complications resulting from possible endogeneity.

The regulatory constraint imposed by a minimum risk-weighted capital ratio implies that the Credit Union must also choose the average risk weight (m_{t+1}) in order to achieve the optimal CAR. This also involves adjusting relative interest rates on different asset classes to alter the composition of loan demand and thus asset mix. Again, we model the choice of a target average risk weight directly.

The total costs to the Credit Union over the period (t, t+1) which is wishes to minimize through capital management are modelled as consisting of two components. The first, the cost of disequilibrium (D), arises from not being at the optimal capital ratio, the long run profit rate (consistent with maintaining that capital ratio) and optimal asset risk mix at date t+1. The second, the costs of adjustment (A), are costs associated with changes in ρ, k, and m between t and t+1.

Disequilibrium costs can be expressed as

$$D = U\left(m^*, k^*, \rho^*\right) - U\left(m_{t+1}, k_{t+1}, \rho_{t,t+1}\right) \tag{4}$$

where U is the utility function of credit union management. Using a Taylor series expansion (up to second order terms) D will be a function of $(m_{t+1} - m^*)^2$, $(k_{t+1} - k^*)^2$, $(\rho_{t,t+1} - \rho^*)^2$ and interaction terms $(m_{t+1} - m^*)(k_{t+1} - k^*)$, $(m_{t+1} - m^*)$ $(\rho_{t,t+1} - \rho^*)$ and $(\rho_{t,t+1} - \rho^*)(k_{t+1} - k^*)$.

The costs of adjustment, A, consist of the costs resulting from changes in the profit rate, the average risk weight, and the capital ratio. Managerial aversion to variability in profitability is well known. Altering the average risk weight involves taking actions (including changing relative interest rates) to change the composition of the asset portfolio, which may necessitate changes in strategy, increased advertising costs, and member dissatisfaction. Variability in the capital ratio from year to year may also impose costs. Regulators may react, with increased surveillance, to declines in the capital ratio, while current members (who bear the cost through less favourable pricing) may object to the higher profit rate required to achieve a faster increase in capital. The costs of adjustment are modelled as quadratic functions of the size of adjustment.

Combining the terms for costs of disequilibrium (D) and the costs of adjustment (A), we obtain the cost function (C) which is to be minimized by choice at time t of m_{t+1} and $\rho_{t,t+1}$.

$$C = \frac{\gamma_1}{2}(m_{t+1} - m^*)^2 + \frac{\gamma_2}{2}\left[k_{t+1} - k^*\right]^2 + \frac{\gamma_3}{2}(\rho_{t,t+1} - \rho^*)^2$$
$$+ \gamma_4 (m_{t+1} - m^*)\left[k_{t+1} - k^*\right] + \gamma_5 (m_{t+1} - m^*)(\rho_{t,t+1} - \rho^*) + \gamma_6 (\rho_{t,t+1} - \rho^*)\left[k_{t+1} - k^*\right] \quad (5)$$
$$+ \frac{\gamma_7}{2}(m_{t+1} - m_t)^2 + \frac{\gamma_8}{2}(\rho_{t,t+1} - \rho_{t-1,t})^2 + \frac{\gamma_9}{2}\left[k_{t+1} - k_t\right]^2$$

In equation (5), increasing costs of disequilibrium and positive adjustment costs mean that γ_1, γ_2, γ_3, γ_7, γ_8 and γ_9 are positive. The coefficients on the interaction terms, γ_4 and γ_5 are assumed negative, since the costs of being above the optimal average risk weight (which would imply a lower CAR than desired) would be moderated to the extent that capital or the profit rate (and accumulation of capital) are above desired levels. The interaction term γ_6 is assumed positive, reflecting the fact that if both the profit rate and the capital ratio are above (below) their optimal values, the next period gap between actual and optimal capital will be greater.

Substituting $k_{t+1} = \frac{\rho_{t,t+1}}{1+g} + \frac{1}{1+g}k_t$ from equation (2), differentiating equation (5) with respect to $\rho_{t,t+1}$ and m_{t+1} respectively and simplifying gives the following first order conditions.[10]

$$\hat{\rho}_{t,t+1} = gk^* + a_1(k_t - k^*) + a_2(\rho_{t-1,t} - \rho^*) + a_3(\hat{m}_{t+1} - m^*)\,, \quad (6)$$

where $a_1 = -\frac{(\gamma_2 - \gamma_9 g + \gamma_6(1+g))}{(1+g)^2\delta}$, $1 > a_2 = \frac{\gamma_8}{\delta} > 0$, $a_3 = \frac{-(\gamma_4 + \gamma_5(1+g))}{(1+g)\delta} > 0$ and $\delta = \frac{\gamma_2}{(1+g)^2} + \gamma_3 + \frac{2\gamma_6}{(1+g)} + \gamma_8 + \frac{\gamma_9}{(1+g)^2}$ (>0). For reasonable values of the cost function parameters, $a_1<0$.

Similarly

$$\hat{m}_{t+1} = m^* + b_1(m_t - m^*) + b_2(\hat{\rho}_{t,t+1} - \rho^*) + b_3(k_t - k^*) \quad (7)$$

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[10] The condition $\gamma_4,\gamma_5 < \min(\gamma_1,\gamma_2,\gamma_3,\gamma_6,\gamma_7,\gamma_8,\gamma_9)$ is sufficient to ensure that the Hessian is positive definite and hence that the second order conditions necessary for equations (6) and (7) to represent minima are satisfied. This is equivalent to assuming (similar to the assumptions in the model of Beatty and Gron (2001) that the direct costs of being away from the equilibrium or the direct costs of adjustment are always larger than the magnitude of any interaction effect between the variables

where $1 > b_1 = \frac{\gamma_7}{\eta} > 0,\ b_2 = -\frac{(\gamma_4 + \gamma_5(1+g))}{\eta(1+g)} > 0,\ b_3 = -\frac{\gamma_4}{\eta(1+g)} > 0,\ \eta = \gamma_1 + \gamma_7 > 0$.

In equation (6) $\hat{\rho}_{t,t+1}$ is the one-period target return on assets for (t, t+1) set by the credit union at time t, given anticipated growth of g for the period $(t, t+1)$, current capital ratio k_t, target capital ratio k*, and previous period return on assets. Note that equation (6) involves setting the planned profit rate ρ equal to its long run target value gk* adjusted for divergences from their long run target values of the inherited capital ratio, the inherited profit rate and the planned risk weight. Our model implies that the planned one-period return on assets in period t,t+1, and observed with error at date t+1, is an increasing function of the asset growth rate anticipated at date t for period t,t+1, a decreasing function of the date t capital ratio (provided γ_2-$\gamma_9 g+\gamma_6(1+g)>0$), an increasing function of the date t average risk weight and an increasing function of the previous period return on assets (observed at date t).

In equation (7) $\hat{m}_{t+1}$ is the one-period target for the average risk weight set by the credit union at time t. Achieving this involves setting m_{t+1} equal to its long term target value m^* plus factors related to the gap between the previous period's average risk weight (m_t) and its long-run target value, the divergence between the planned return on assets ($\rho_{t,t+1}$) and its long-run target value, and the gap between the start of period capital ratio (k_t) and its long-run target value. Our model predicts that the one-period target average risk weight is an increasing function of the previous period's average risk weight, an increasing function of the current period's return-on-assets and an increasing function of the previous period's capital ratio.

We operationalize the model for our empirical work by assuming that the actual profit rate (ρ_t) and average risk weight (m_t) observed at date t equal their target values (planned at date t-1) plus random error terms (u_t and v_t respectively) which are uncorrelated with other variables (and each other). We also assume that expected asset growth is an unbiased forecast of the actual growth rate.

The resulting regression equations (8) and (9), in which subscripts i and t refer respectively to credit union i and time t respectively, are obtained from equations (6) and (7) by linearising. The expected signs of the coefficients are indicated below the coefficient and are consistent with the signs of the coefficients from equations (6) and (7).

$$\rho_{i,t} = \alpha_{0,i} + \underset{>0}{\alpha_1} m_{i,t} + \underset{<0}{\alpha_2} k_{i,t-1} + \underset{>0}{\alpha_3} g_{i,t} + \underset{>0}{\alpha_4} \rho_{i,t-1} + u_{i,t} \tag{8}$$

$$m_{i,t} = \beta_{0,i} + \underset{>0}{\beta_1} m_{i,t-1} + \underset{>0}{\beta_2} \rho_{i,t} + \underset{>0}{\beta_3} k_{i,t-1} + v_{i,t} \tag{9}$$

We allow for the possibility that long term target capital ratios and risk weights may vary between credit unions by allowing for cross sectional effects reflected in the terms $\alpha_{0,i}$ and $\beta_{0,i}$. Note that the intercept term ($\alpha_{0,i}$) in equation (8) corresponds to the amalgam of terms ($k^*(g-a_1) - a_2\rho^* - a_3m^* = k^*(g(1-a_2)-a_1)-a_3m^*$) from equation (6). Since $a_1<0$, $0<a_2<1$, and $a_3 > 0$, $\alpha_{0,i}$ will be higher (*ceteris paribus*) for a credit union which has a higher long term capital ratio target, a higher long term expected growth rate and a lower long term target average risk weight. Similarly, $\beta_{0,i}$ in equation (9) corresponds to $m^*(1-b_1)-b_2\rho^*-b_3k^*$. It will thus be higher for credit unions with higher long term target average risk weights and lower long term profit and capital ratio targets.

The simultaneity between *ρ* and *m* reflects two features of our model. First, a higher average risk weight will tend to increase the profit rate, because the resulting higher unweighted capital ratio implies a need for a higher return on assets (for a given growth rate) to maintain that ratio.[11] Second, the possibility that credit unions may adjust their portfolio composition and thus average risk weight as part of capital management strategies when faced with regulatory requirements based on a risk weighted capital ratio suggests that current profitability may influence average risk weight. For example, credit unions facing a risk weighted capital constraint and with low profitability may choose to reduce average risk weight, thus leading to a positive relationship.

The possibility that system wide shocks not captured by other explanatory variables may simultaneously affect actual profitability or asset composition (and thus average risk weight) can be allowed for by incorporation of time series effects in our panel data regressions. This is considered in section 6, together with the case for inclusion of other relevant explanatory variables not allowed for explicitly in our theoretical modelling. Since some of those variables result from institutional features of the credit union sector, we first provide an overview of that sector and data sources.

[11] Note that a higher capital ratio implies less interest expense and would thus be expected to be associated with a higher return on assets (for a given return on equity).

5. Australian Credit Unions: Trends and Data Sources

At the end of 2003 there were approximately 190 credit unions operating in Australia, less than half the 1990 population due to significant merger activity.[12] The largest fifty (which are the focus of this study) had assets ranging from around $100m to almost $2 billion, but there were also still many small institutions with assets below $10 million. Australian credit unions have been subject to minimum capital requirements since the early 1990s, with formal application of the Basel Accord risk weighted capital requirements applying since October 1992. Over our sample period of 1992 to 2004, there has been only one credit union which has utilised a public issue of subordinated debt as a source of tier two capital. Thus credit union managers have relied on generating surpluses to meet regulatory (or internally desired) capital needs arising from asset growth. In a number of cases, management of institutions with poor capital positions and profitability, but strong growth prospects, and those of well capitalised, slower growing institutions have found natural attractions in merger opportunities.

Credit union management has considerable autonomy because of the mutual governance arrangements and together with (at least) some short term degree of market power can act to increase capital (to meet regulatory requirements or personal managerial goals) by targeting high profit rates.[13] Some constraints do however exist. The capital generated is a form of communal wealth providing future benefits (but not accessible by the current members) achieved at the expense of not providing better terms (interest rates) on transactions with current members. Provided that members value a dollar of communal wealth (accumulated capital) less than a dollar of private wealth, existing members would prefer that the credit union limit increases in communal wealth by not pursuing profits and instead deal on more favourable terms with members.

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[12] Davis (2007) provides more information on recent developments in the credit union sector in Australia.

[13] Australian credit unions pay company tax, and hence Net Profit after Tax is the amount available to increase capital (and the variable used in measuring return on assets or equity). Since (unlike in some other countries) legislation prohibits declaring a dividend at year's end (and all members' deposits specify an interest rate *ex ante*), net profit after tax equals the net income retained to increase capital. While Australian credit unions can declare a rebate of interest on loans to members, to our knowledge none has ever done so. It is also worth noting that inability to pay dividends means that tax credits arising from company tax payments under Australia's imputation tax system cannot be distributed to members, creating a competitive disadvantage vis a vis joint stock companies whose owners can use such tax credits attached to dividend payments to reduce personal tax payments.

This together with competition from other institutions places a constraint on the ability to generate capital from internal sources. An alternative response to capital shortages, involves changing asset portfolios to lower the average risk weight. Several constraints have existed in this regard. First, at the start of the sample period, few credit unions were significantly active in housing mortgage finance – for which the risk weight is 50% compared to a personal lending risk weight of 100%. Over time housing lending has increased – and this is reflected in lower average risk weights, but the ability to adjust the composition of the loan portfolio over a short time horizon is limited. Second, regulatory requirements applying until the late 1990s[14] meant that credit unions were required to ensure that, at all times, no less than 60 per cent of their total assets were in the form of financial accommodation (loans) to members rather than in liquid assets (with lower risk weights). In mid 1992 many credit unions were approaching or in breach of this limit. Since then, liquidity ratios for many credit unions have fallen as expansion into housing loans has occurred, with the decline in low risk weight liquid assets moderating the effect of the shift into housing lending on average risk weights.

Summary data illustrating key features of large credit union experience between 1991 and 2004 are contained in Table 1, and illustrate phenomena which our modelling of individual credit union capital management seeks to explain.

First, it is apparent that there has been an overall increase in capital ratios, both risk weighted and non-risk weighted, with most of the increase occurring in the first half of the 1990s in conjunction with the introduction of an 8 per cent risk weighted capital requirement.[15] Notably, this occurred at a time of very high growth for credit unions, and thus required very high profit rates – an outcome consistent with the hypothesis that credit unions have some degree of market power in dealing with their members. Subsequent years have seen a tendency towards stabilisation of capital ratios accompanied by slower growth and lower profit rates. Second, there has been, and remains, considerable cross sectional variation in capital ratios, consistent with the hypothesis that absence of capital market discipline provides management with

[14] This was one of the provisions of the Financial Institutions (State) Act 1992, which was not continued in the new legislation introduced with the creation of the new Federal prudential regulator APRA in 1998.

[15] Hillier, Hodgson and Stevenson-Clarke (2002) also identify a large increase in both the mean and median risk-weighted capital ratio from 1992 to 1994, but argue that this reflects "window dressing" through reclassification of advances into lower risk weight categories.

significant discretion in deciding upon an optimal capital position. Third, although there appears to be significant correlation of individual asset growth rates (and also profitability) over time, there is considerable cross sectional variation in asset growth rates and in profitability. Finally, there is some indication of a decline in the average risk weight of assets over time, consistent with the hypothesis that credit unions have shifted into lower risk weighted assets (such as housing loans) to reduce their need for capital. However, such an interpretation based on trends in aggregate data is clouded by two factors. First, increasing involvement in housing lending could be a trend independent of capital requirements, and it is thus necessary to examine cross sectional variation in such trends to discern any link to capital positions. Greinke (2005) finds evidence of a trend effect (for his sample ending in 1997) and in cross sectional regressions with the trend coefficient as the dependent variable finds that credit unions which were larger, and those with lower risk weighted capital ratios, displayed a greater shift into housing loans. Second, substantial variations in the relative importance of holdings of low risk weighted liquid assets (both temporally and cross sectionally) as reflected indirectly in the loans/ total asset ratio, have occurred and also create a need for analysis at the level of the individual credit union.

The primary source of data used in this study is The Financial Institutions Performance Survey (FIPS) which has been conducted annually by KPMG since 1984. The survey collects information from major credit unions (assets in excess of $50 million) on a number of key financial and non-financial variables and ratios, categorised by strength/soundness, size, growth, profitability, efficiency, and credit quality. Statistics are currently extracted from Australian Prudential Regulation Authority Returns and group accounts where applicable. Data for this study is collected from 1987 and missing data has been supplemented where possible by direct referral to credit union annual reports. The fiscal year refers to the period July 1 – June 30, except for a small number of individual cases in early years of the sample where balance dates of March or September occur.

Because FIPS provides data for a varying number of the largest credit unions (varying from around 30 in the mid 1980s to a maximum of 62 in 2002), and because of mergers and name changes in the industry the data have been hand checked to ensure consistency of the time series used.[16] To deal with the varying sample over time, a subgroup of credit unions for which data was available for most years between 1992 till 2004 was used in the empirical work. Credit unions engaged in significant mergers over this period were excluded[17], and a merger dummy variable used to indicate (and allow for) instances in which credit unions engaged in “small” mergers had an abnormally high recorded growth rate due to the merger. While it would have been desirable to utilise earlier data, gaps in the data, and most specifically estimates of an average risk weight and risk weighted capital ratio were not available for that period.

In total, 50 credit unions are included in our sample. Of these, 40 credit unions have complete data available for the period 1992 to 2004, and there is a very small number of missing observations for some variables in 7 cases. For the remaining 3 cases, mergers with other large credit unions mean that available data finishes in 2002.

Table 2 lists the variables drawn from the FIPS and transformations applied to derive the variables used in our empirical work.

6. Equation Specification and Estimation Methods

Equations 8 and 9 provide the theoretical basis of the simultaneous equations model to be estimated, but need to be augmented to allow for other relevant influences upon observed profit rates and average risk weights.

Actual profit rates will be affected by loan losses incurred in the period and thus doubtful debt expense (dde) is included as an additional explanatory variable (with an anticipated negative coefficient) in the equation for profit rates. Australian accounting standards also lead to an expectation that provisions for doubtful debts (at the end of the previous period) would have a positive effect on profit rates. The reason is that assets (and capital) are recorded net of (general and specific) provisions for doubtful debts. The effect is that a higher level of general provisions (arising from

[16] This also revealed a number of coding errors in the data which were corrected.
[17] This led to the exclusion of two currently very large credit unions which have resulted from a number of mergers over the sample period.

past policies and not related to specific impaired assets) will mean a lower reported asset value but no difference in reported level of profit. Hence, we include provision for doubtful debts (pdd), lagged, as an explanatory variable in the equation for profit rates, with an expected positive coefficient.

Mergers would artificially increase the recorded growth rate of the relevant credit union in the year in which they occur. Consequently, a dummy variable ("merger", taking a value of unity for those credit union-year cases when a merger occurs) is included multiplicatively with the growth rate in the profit rate equation. Its coefficient is expected to be negative.

Prior studies of bank capital management have consistently found that size, measured by the log of total assets, is a significant explanatory variable in capital adjustment equations, with a negative coefficient. This is often rationalised as size being a proxy for ease of access to external equity markets, such that large banks are able to operate with a lower capital buffer over the regulatory minimum requirement. Given our sample of mutual institutions, where external capital is not available, this explanation cannot apply, and any finding that size affects capital management would need to be rationalised in some other way. We thus include log(TA) as an additional explanatory variable in the equation for profit rates, with an expectation of finding no significance if size is acting solely as a proxy for ease of access to capital markets in other studies.

Liquidity fluctuations will affect the average risk weight of assets and thus the loans/total assets ratio (LTA), which is inversely related to liquidity, is included as an additional explanatory variable (with an expected positive sign) in the equation for average risk weights. Growth can also be expected to affect the average risk weight, although the sign of the effect is an empirical matter. If growth arises from inflows of deposits which cannot be readily matched by increased lending, or if growth involves expansion into housing lending (with a risk weight of 50 per cent) which reduces the share of personal lending, a negative relationship between the asset growth rate and average risk weight would occur. Alternatively, if growth is driven by high demand for high risk weight loans, the average risk weight would be inversely related to the asset growth rate. Given the declining share of personal (unsecured) lending in credit union activities, we expect the relationship between growth and average risk weight to be negative.

We have hypothesized that target capital ratios can vary across credit unions for reasons such as differences in conservatism of management, perceived credit risk of member loans, turnover of membership, nature of common bond. Consequently there will be differences between credit union target profit rates which are unrelated to other variables in the model, and these are incorporated as cross sectional effects in the profit equation. It is also possible that there is variation across credit unions in terms of their long run desired average risk weight, and cross sectional effects are therefore also allowed for in the risk equation. To capture the gradual decline in average risk weights arising from changes in the composition of credit union activities over time, we allow for a time trend in the average risk weight equation. With these additions, the estimating equations become:

$$\begin{aligned}\rho_{i,t} = \alpha_{0,i} &+ \underset{>0}{\alpha_1} m_{i,t} + \underset{<0}{\alpha_2} k_{i,t-1} + \underset{>0}{\alpha_3} g_{i,t} + \underset{>0}{\alpha_4} \rho_{i,t-1} + \underset{<0}{\alpha_5} dde_{i,t} \\ &+ \underset{<0}{\alpha_6} g_{i,t} xmerger_{it} + \underset{?}{\alpha_7} \log(TA_{i,t}) + \underset{>0}{\alpha_8} pdd_{i,t-1} + u_{i,t}\end{aligned} \tag{10}$$

$$m_{i,t} = \beta_{0,i} + \underset{>0}{\beta_1} m_{i,t-1} + \underset{>0}{\beta_2} \rho_{i,t} + \underset{>0}{\beta_3} k_{i,t-1} + \underset{>0}{\beta_4} LTA_{i,t} + \underset{<0}{\beta_5} g_{i,t} + \beta_6 t + v_{i,t} \tag{11}$$

where t represents the time trend.

Equations (10) and (11) constitute a dynamic panel, simultaneous equation, system, which can be estimated using GMM techniques. Consistent estimation of the parameters of (10) and (11) requires that instruments be chosen which are orthogonal to the disturbance terms. We adopt the approach introduced by Arellano and Bond (1991).[18] Equations (10) and (11) are first differenced (to remove the cross section specific effects) and differenced values of (lagged and/or current) ρ_{it} and m_{it} in each equation replaced by combinations of appropriate lagged values as instruments. In addition, the actual growth rate (g_{it}) is arguably endogenous, since credit union management may alter interest rate settings (and thus profitability) to affect asset growth rates as a way of altering the current need for additional capital. To deal with this latter potential complication we use as instruments for $g_{i,t}$, the lagged individual credit union growth rate ($g_{i,t-1}$) and the average growth rate for all credit unions in year t (avg_t).[19]

[18] As implemented in Stata using command "xtabond".
[19] Use of this industry wide variable as an instrument with significant time variation also works to capture period effects which might otherwise be captured by use of period dummies.

6. Results

Table 3 presents the results of estimating equations 11 and 12 using the sample of 50 Australian credit unions for which data was available for the period 1992-2004. The estimation technique is the one step Arellano-Bond (1991) estimator with robust standard errors as described above.[20] In general, the results conform with the predictions of the model, and are statistically significant.[21]

There is no evidence (given the lack of significance of ρ_{it} and m_{it} as explanatory variables in the regression equations for each other) that the average risk weight affects the return on assets nor the reverse relationship. This indicates that, for Australian credit unions, capital management and risk management are not interrelated in the short run. Given the time lags and costs involved in adjusting the average risk weight of assets, this is not surprising.

Considering first the results for the profit equation, the lagged capital adequacy ratio has a negative effect on the profit rate. This is as predicted by our model, and reflects the fact that credit unions with capital ratios above (below) their target capital ratio need to lower (increase) their profit rate to approach that target.

The coefficient on the credit union's growth rate is positive as hypothesised. As previously explained, higher growth rates create a need for bigger increases in capital, in order to maintain capital ratios, and this can only be achieved by higher profit rates.

The model predicts that the profit rate will be positively related to the lagged profit rate, reflecting managerial aversion to fluctuations in profit rates over time. This hypothesis is supported. Doubtful debts expense has, as hypothesised, a negative effect on profit rates, reflecting the cost of loan losses. The coefficient on the merger dummy is also negative as hypothesised indicating that measured growth is artificially

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[20] When the two-step estimator is used, coefficient estimates for both equations are basically unchanged, although standard errors are substantially lower. The Sargan test of overidentifying restrictions for the two-step estimator of the profit (risk weight) equation was a chi-squared value of 48.59 (47.39) which with 272 degrees of freedom does not reject the null hypothesis that the overidentifying restrictions are valid.

[21] The hypothesis of zero second order autocorrelation in the residuals of the first-differenced equation is not rejected, consistent with the conditions required for identification.

inflated in that period and that the return on assets will be less than predicted by reference to the measured growth rate alone.

Finally, there is evidence of a negative relationship between size and return on assets suggesting that larger credit unions are less able to quickly adjust profit rates to achieve desired increases in capital. As noted earlier, studies of bank capital management have found a role for size, and attributed this to differences in ease of access to external equity capital markets. Since credit unions cannot access external equity, the finding of a role for size, suggests that some other factors may be relevant. In particular, larger credit unions may be more exposed to market competition, and thus less able to adjust short run profitability to generate capital internally. Whether the same phenomenon can also explain the finding of a size effect in studies of bank capital management warrants further investigation.

Turning to the results for the average risk weight, it can be seen that it is strongly positively correlated with the previous year's value (as expected) and has been subject to a general decline (as reflected in the negative coefficient of the time trend variable). This reflects a gradual increase in the importance of housing lending which has a lower risk weight than personal lending.

Changes in liquidity also play an important role as shown by the positive coefficient of the loans to total assets ratio. An increase in total loans in the portfolio (ie less low risk-weighted liquid assets) increases the average risk weight.

Higher growth leads to a decline in the average risk weight. As suggested earlier, this is consistent with the experience over the sample period of asset growth reflecting an ongoing expansion into housing lending by credit unions and driving down the average risk weight. This result is thus likely to be sample specific and not generalizable to other markets.

It is instructive to examine the capital adjustment processes implicit in these results. We do this by way of simulation. Using the estimated parameters from equation (10) we consider the impact of a change in the growth rate of a hypothetical credit union which is initially in equilibrium (such that equation (3) holds).[22] Figure 1

[22] We choose initial values of profitability, capital ratio, and average risk weight (and other variables in equation 10) close to the mean value for credit unions in the last year of our sample, and a constant term for the equation such that the credit union is initially in equilibrium. We assume (consistent with

shows the effect of increasing the growth rate from g = 0.08 to 0.09. Several features warrant comment. First, the new equilibrium involves a higher profit rate and a lower capital ratio as hypothesized earlier. This reflects the fact that the cost of increasing profits to accumulate capital which would be imposed on current members leads to a willingness to operate with a lower equilibrium capital ratio. In this hypothetical case, the equilibrium return on assets increases from 6.073% to 6.602% and the capital ratio falls from 7.59% to 7.34%. The adjustment of the profit rate to the new equilibrium is relatively slow, with around 13% of the gap closed in the first year and taking 3 years for fifty per cent of the gap to be closed. In contrast fifty per cent of the capital ratio equilibrium gap is closed in two years, because of the depressing effect of the higher growth rate on the ratio.

It is worth noting that achieving the new equilibrium in this simulation assumes that credit unions have sufficient market power to operate with a return on equity equal to the exogenously assumed asset growth rate (which is a condition implied by the equilibrium condition given in equation 3). Since profit-oriented competitors may set prices based on a different target return on equity, this may not be feasible and the long run asset growth rate more suitably treated as endogenous. However, the results from our regressions do indicate some degree of short run market power for credit unions in dealing with their members.

It is not feasible to extract information on individual credit union desired long-run capital ratios from our panel data results in order to examine the argument of Deshmukh, Greenbaum and Thakor (1982) that managers have an incentive to continually accumulate capital and that higher capital ratios are associated with higher profitability. As previously discussed, costs imposed on current members from capital accumulation inhibit the incentive to accumulate capital, and our results show that in the short run, the relationship between profitability and capital ratios is negative – in contrast to the longer run relationship expected by Deshmukh et al.

To examine the longer run relationship between capital ratios and profitability anticipated by Deshmukh *et al*, we performed simple cross sectional regressions of credit union returns on assets against capital ratios for two periods. These were 1992-1996 and 2000-2004 which correspond to the beginning and end of our sample period,

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our findings) no feedback effects between profitability and average risk weight (which is held constant throughout the simulation).

with averages over a number of years being taken to reduce the impact of other short term influences on returns and short-run adjustment processes. For the period 1992-1996 we do find a positive relationship with significance at the 1 per cent level. However, for the later period, the relationship is insignificant (with a "p-value" for the regression coefficient of 0.43). These inconclusive results on the longer-run relationship between capital ratios and profitability in financial mutuals hypothesized by Deshmukh *et al* suggest that further detailed research is warranted on the issue.

We also provide some indicative results on long run capital targets, to consider whether there is a managerial incentive for ongoing capital accumulation. Figure 2 shows how the capital ratios of individual credit unions have changed over time relative to the sample average. Specifically, it shows the percentage deviation of each credit union's capital ratio from the average (of 8.9 percent) over the period 1992-1996 on the horizontal axis and from the average (of 9.7 percent) over the period 2000-2004 on the vertical axis. If there is some tendency towards a common mean, we would expect to see a clustering of observations in regions II and V (where the deviation from the average has declined) and in regions I and IV (where the deviation has changed sign). While there is a majority of observations in these regions, there are a substantial (28 per cent) of credit unions in region III whose capital ratios have moved further above the industry average over time. There are also 11 per cent of credit unions in region VI, whose capital ratios have moved further below the industry average over time. These results are suggestive of an absence of pressures for convergence to a common "optimal" capital structure for mutual financial institutions as hypothesized, although further research is clearly warranted.

Overall, our results support the predictions of the model and illustrate the importance of profit management as the main tool of capital management for credit unions. It is also useful to consider these results in the context of the aggregate trends presented in Section 2. The positive relationship between growth and profit rate found in the regression results appears on the aggregate trends in these variables. As capital ratios have increased over time and stabilised in the latter part of the sample period, profit rates have also declined and stabilised.

7. Conclusions

In this paper we have developed a dynamic model of capital management in mutual credit unions which reflects the lack of access to external capital for such institutions. The model is used to examine the capital management behaviour of Australian credit unions over the period 1992-2004, following the introduction of minimum risk weighted capital requirements.

The model developed emphasises the key role of profit management in capital management for credit unions and predicts that profit rates (return on assets) will be higher for credit unions with low capital ratios and higher growth prospects, and will be positively related to past profit rates. Estimation of the model using data for larger Australian credit unions supports these predictions, and indicates that Australian credit unions have some degree of short term market power in dealing with members, and that management attempts to smooth profitability. We do not find evidence of interrelationship between short run capital management and risk management (as proxied by average risk weights) for Australian credit unions.

Consistent with our hypothesis, and reflecting managerial autonomy and absence of equity market pressure, we find no evidence of capital ratios of credit unions tending towards some uniform target ratio. However, our results do not support the arguments of Deshmukh *et al* of a positive relationship between capital ratios and profitability, and a tendency for managers to continually increase capital ratios. The implicit costs on current members from increasing capital (via increased profits) inhibit such managerial incentives, and this effect is reflected in our simulation results which find that managers will respond to higher long term growth by adopting a lower capital ratio target.

Our results also show that size influences capital management behaviour. Since institutions in our sample had no access to external equity capital, this finding casts doubt on the conjectures made in previous studies of capital management that an observed “size” effect reflects differential access to equity markets.

Our results are consistent with the findings of Harrington and Niehaus (2002) for mutual insurance companies that capital ratios of mutual organizations are sensitive to income, but involve taking a different perspective on the relationship. In our sample of credit unions, profit rates (income) are sensitive to the capital position and are set to achieve convergence to an equilibrium capital ratio, although the adjustment is quite slow. Using a simple deterministic simulation of our model we find that after a shock to growth rates it takes around 2 years for 50 percent of the adjustment of the capital ratio to its long run target to occur. Consistent with their arguments, the capital ratios for Australian credit unions are significantly higher than those of competing non-mutual financial institutions, but we also find evidence suggestive of significant sustained cross sectional variation in target capital ratios of Australian credit unions. Explaining the causes of this variation is a task for future research.

Table 1: Summary Statistics for Large Australian Credit Unions (1991-2004)

	Non-Risk Weighted Capital Ratio			Risk Weighted Capital Ratio			Asset Growth Rate			Average Risk Weight			Return on Assets			Loans / Total Assets		
	Percentile			*Percentile*			*Percentile*			*Percentile*			*Percentile*			*Percentile*		
YEAR	0.2	0.5	0.8	0.2	0.5	0.8	0.2	0.5	0.8	0.2	0.5	0.8	0.2	0.5	0.8	0.2	0.5	0.8
1991	5.2	7.4	10.6	7.5	11.0	14.5	-0.1	7.9	14.6	0.62	0.72	0.82	0.80	1.16	1.57	76.4	80.2	83.7
1992	5.5	7.7	10.3	8.0	10.7	15.5	8.3	12.3	20.5	0.63	0.71	0.77	1.02	1.45	1.76	71.4	79.6	85.0
1993	6.3	8.4	10.2	9.2	12.6	15.6	10.2	15.3	22.4	0.59	0.65	0.72	1.04	1.44	1.86	70.2	78.2	81.3
1994	6.8	9.5	11.5	10.3	14.7	17.3	6.4	12.2	17.1	0.60	0.65	0.71	1.27	1.60	2.22	69.8	77.9	81.3
1995	7.1	9.1	12.0	10.4	13.9	16.7	6.9	13.5	19.8	0.61	0.67	0.74	0.77	1.10	1.37	75.8	79.5	82.2
1996	7.0	8.9	12.5	10.8	14.1	17.4	7.4	10.5	15.5	0.61	0.66	0.70	0.76	1.01	1.33	74.0	80.2	82.8
1997	7.1	9.2	12.1	11.2	13.6	17.3	3.7	9.1	13.8	0.61	0.67	0.72	0.72	1.07	1.42	75.1	80.2	83.6
1998	7.2	9.9	12.7	11.4	14.0	18.1	2.6	7.7	14.0	0.61	0.67	0.72	0.50	0.71	0.87	77.0	82.7	84.7
1999	7.0	9.6	12.9	11.7	14.3	19.6	4.4	9.2	13.3	0.61	0.65	0.70	0.43	0.78	1.04	77.4	82.5	85.4
2000	7.1	9.3	12.9	12.0	13.8	20.7	1.3	6.8	12.8	0.57	0.62	0.70	0.32	0.59	0.84	78.5	84.4	86.0
2001	7.4	9.1	12.6	12.1	14.2	20.1	5.6	10.8	15.8	0.55	0.62	0.66	0.29	0.63	0.85	72.8	79.8	84.3
2002	7.4	9.2	12.2	11.7	13.7	20.0	1.4	6.3	11.0	0.58	0.63	0.69	0.25	0.63	0.86	76.0	80.9	85.1
2003	7.3	8.8	11.4	12.4	14.0	18.6	4.5	11.1	17.1	0.55	0.62	0.69	0.32	0.66	0.83	74.6	80.3	84.2
2004	7.1	8.6	11.0	12.1	14.3	17.7	3.0	10.0	15.1	0.55	0.60	0.65	0.41	0.71	0.98	78.1	81.7	84.5

Source: KPMG Financial Institutions Performance Survey and Original Data. These figures exclude cases in which significant mergers distort figures for that year.

TABLE 2: Variable Descriptions and Sources

Variable	Description	Source/ Definition
ROE_t	Return (after tax) on average equity for period (t-1, t)	FIPS
TA_t	Total assets at time t	FIPS
NA_t	Net assets (equity) at time t	FIPS
CAR_t	Risk weighted capital adequacy ratio at time t	FIPS
LTA_t	Loans to members as proportion of total assets at time t	FIPS
dde_t	Doubtful debt expense as proportion of receivables for period (t-1, t)	FIPS
pdd_t	Provision for Doubtful debts as proportion of receivables at date t	FIPS
m_t	Average risk weight at time t	$m_t = NA_t / (TA_t \text{ x } CAR_t)$
ρ_t	Return on average assets for period (t-1,t)	$\rho_t = ROE_t x (NA_t + NA_{t-1}) / (TA_t + TA_{t-1})$
g_t	Growth rate of assets for period (t-1,t)	$g_t = TA_t / TA_{t-1} - 1$
k_t	Non risk weighted capital ratio at time t	$k_t = NA_t / TA_t$
$Merger_{i,t}$	Dummy variable = 1 if a merger occurred for credit union i in period (t,t-1)	

Table 3: Credit Union Capital Management

This table presents estimates of the regression models:

$$\rho_{i,t} = \alpha_{0,i} + \underset{>0}{\alpha_1}\, m_{i,t} + \underset{<0}{\alpha_2}\, k_{i,t-1} + \underset{>0}{\alpha_3}\, g_{i,t} + \underset{>0}{\alpha_4}\, \rho_{i,t-1} + \underset{<0}{\alpha_5}\, dde_{i,t} + \underset{<0}{\alpha_6}\, gdum_{it} + \underset{?}{\alpha_7} \log(TA_{i,t-1}) + \underset{>0}{\alpha_8}\, pdd_{i,t-1} + u_{i,t}$$

$$m_{i,t} = \beta_{0,i} + \underset{>0}{\beta_1}\, m_{i,t-1} + \underset{>0}{\beta_2}\, \rho_{i,t} + \underset{>0}{\beta_3}\, k_{i,t-1} + \underset{>0}{\beta_4}\, LTA_{i,t} + \underset{<0}{\beta_5}\, g_{i,t} + \beta_6 t + v_{i,t}$$

where subscripts i and t refer to credit union i and time period ending date t. ρ_t is return on assets, m_t is the average risk weight, k is the risk-weighted capital adequacy ratio, g is the growth rate of assets, dde is doubtful debts expense/assets, gdum is an interactive dummy variable equal to the credit union's asset growth rate in years of a merger and zero otherwise, log(TA) is log of total assets, pdd is provision for doubtful debts, LTA is loans/total assets, t is a time trend. The equation is estimated using the Arellano-Bond (1991) one-step approach with robust standard errors. The sample period is annual observations from 1992 -2004 and there are 50 credit unions included in the sample. Total observations are 592 (and the panel is unbalanced because of missing observations for a small number of data points). The equations are estimated using Stata's "xtabond" command. ρ and m are treated as endogenous variables as is g, for which instruments of g_{t-1} and avg (average industry asset growth) are used.

Dependent Variable: Return on assets (ρ_t)

Number of observations = 592, Number of groups = 50

Wald $\chi^2(8)$ = 134.20 Observations per group: min = 7; avg = 11.84; max = 13

Explanatory Variable	Expected coeff. sign	Coefficient	Robust Std. Error	z-Statistic	P-value.
Lagged Return on Assets (ρ_{t-1})	+	0.21575	0.08590	2.51	0.012
Average Risk Weight (m_t)	+	-0.00050	0.00372	-0.14	0.892
Growth Rate (g_t)	+	0.00689	0.00310	2.22	0.026
Lagged Capital Adequacy Ratio (k_{t-1})	-	-0.13575	0.01746	-7.77	0.000
Doubtful Debts Expense (dde_t)	-	-0.00726	0.00131	-5.53	0.000
Provision for Doubtful Debts (pdd_{t-1})	+	0.00091	0.00074	1.22	0.222
GrowthxMerger Dummy ($gdum_t$)	-	-0.00799	0.00390	-2.05	0.040
Log of Total Assets ($\log(TA_{t-1})$	?	-0.00805	0.00199	-4.05	0.000
		0.00031	0.00019	1.66	0.096

Arellano-Bond test that average autocovariance in residuals of order 1 is 0:
H0: no autocorrelation z = -4.74 Pr > z = 0.0000
Arellano-Bond test that average autocovariance in residuals of order 2 is 0:
H0: no autocorrelation z = -0.52 Pr > z = 0.6003

Dependent Variable: Average Risk Weight (m_t)

Number of observations = 568, Number of groups = 50

Wald $\chi^2(8)$ = n.a Observations per group: min = 8; avg = 11.36; max = 13

Explanatory Variable	Expected coeff. sign	Coefficient	Robust Std. Error	z-Statistic	P-value.
Lagged risk weight (m_{t-1})	+	0.450	0.056	8.07	0.000
Lagged Return on Assets (ρ_{t-1})	+	1.487	0.881	1.69	0.092
Growth Rate (g_t)	-	-0.180	0.042	-4.32	0.000
Lagged Capital Adequacy Ratio (k_{t-1})	+	0.192	0.303	0.64	0.525
Loans/Total Assets (LTA_t)	+	0.286	0.040	7.13	0.000
Time trend (t)	-	-0.003	0.001	-2.93	0.003

Arellano-Bond test that average autocovariance in residuals of order 1 is 0:
H0: no autocorrelation z = -4.11 Pr > z = 0.0000
Arellano-Bond test that average autocovariance in residuals of order 2 is 0:
H0: no autocorrelation z = -1.07 Pr > z = 0.2830

FIGURE 1: SIMULATION RESULTS
This figure shows the simulated effect of an increase in the growth rate from 8% p.a. to 9% p.a. on the capital ratio (k) and return on assets (ρ) of a hypothetical credit union, using the parameter values reported in Table 3. Initial values of variables were chosen so as to be close to the actual mean values for the sample for 2004. The simulation was run for 20 years prior to and after the change in g to ensure equilibrium had been reached and the equilibrium condition $\rho^*=gk^*$ described in equation (3) met.

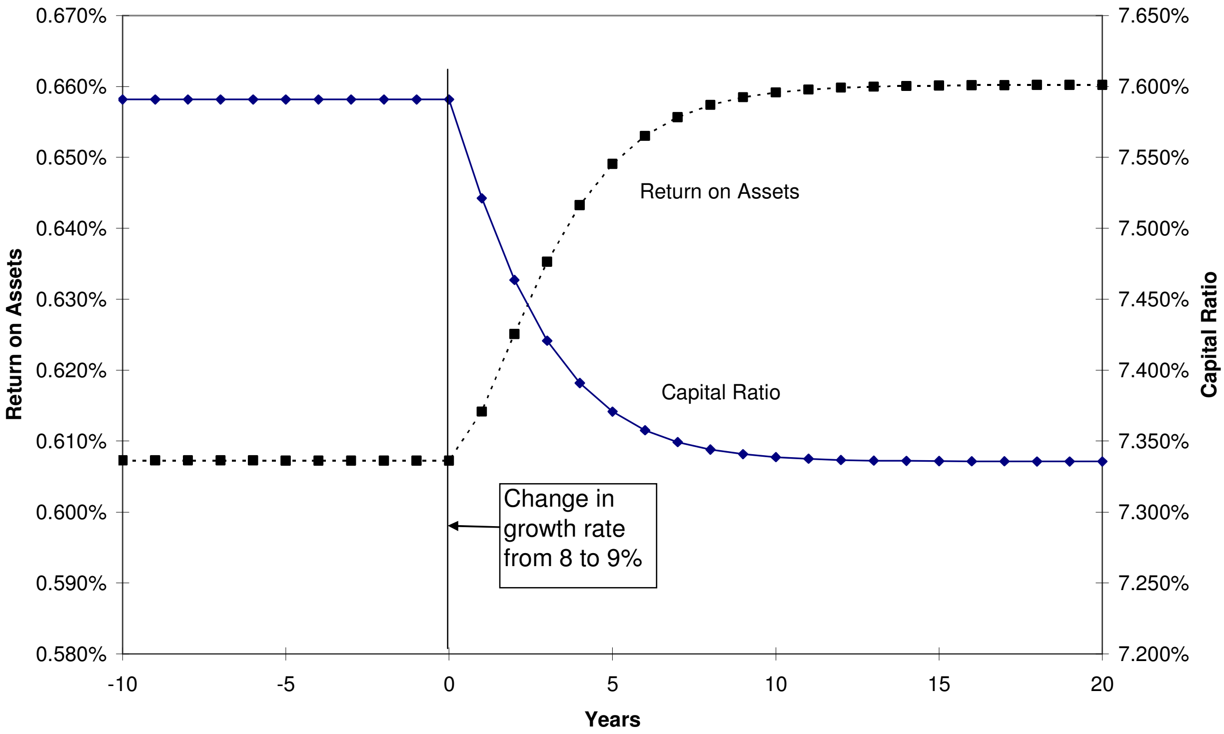
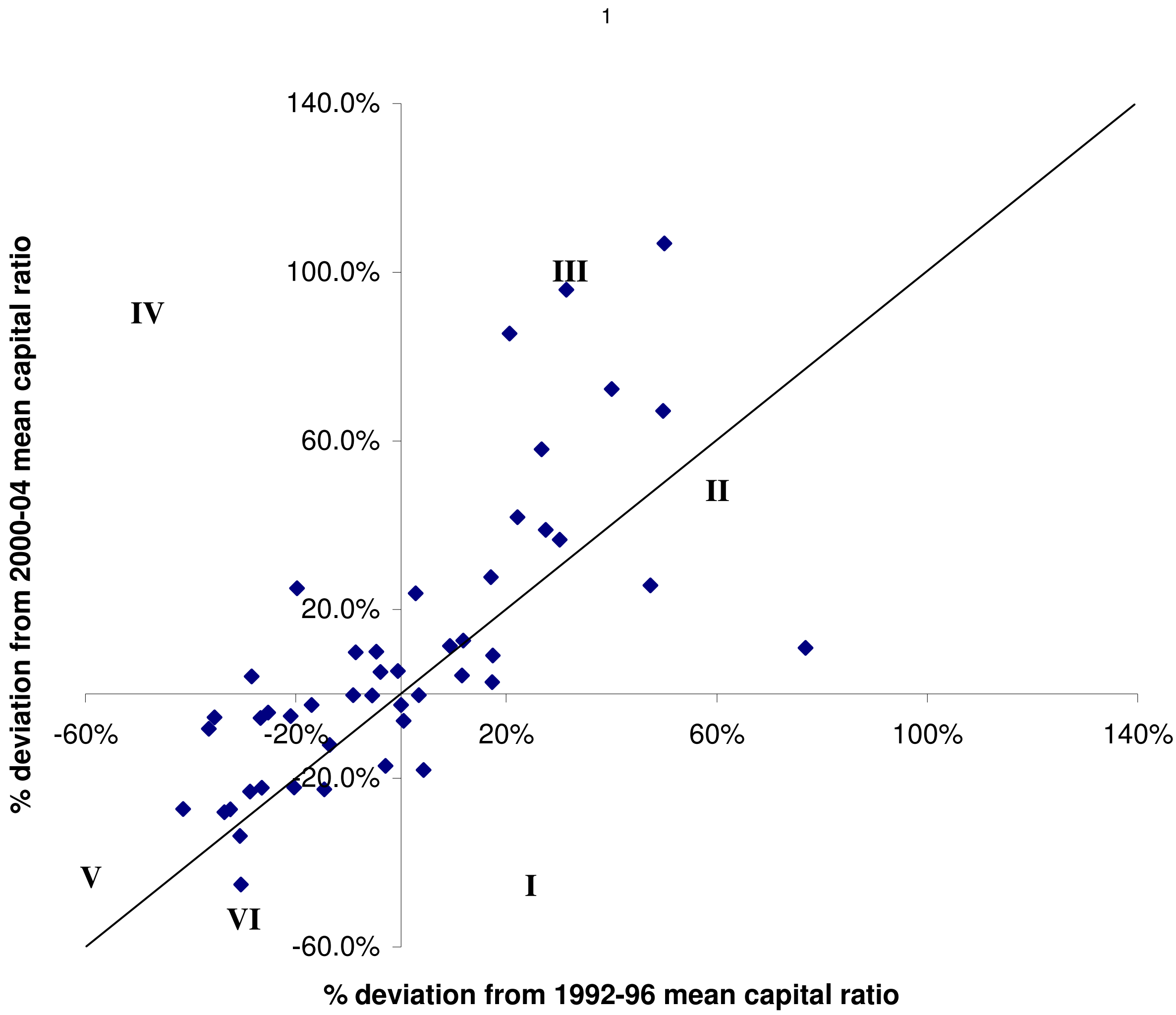


FIGURE 2 TRENDS IN INDIVIDUAL CREDIT UNION CAPITAL RATIOS

This figure plots the deviation of each credit union's capital ratio from the sample average for the period 1992-1996 (horizontal axis) and 2000-2004 (vertical axis). Observations in regions III and VI indicate credit unions whose capital ratios have moved further away from the sample average over time.



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