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CREDIT UNIONS:

An Economic Theory of a Credit Union

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THE majority of research to date on CUs has been empirical (cf. Çargill [1] and Kidwell and Peterson [7]), yet there is serious need to develop a theoretical framework of CU behavior that incorporates their unique characteristics. A CU is essentially a financial intermediation cooperative. However, the standard theoretical treatments of financial intermediaries (cf. Meyer [8]) and cooperative enterprises cannot be directly applied to model credit union behavior. There are two principal characteristics of CUs that prevent this:

First, in a CU (and cooperatives in general) the members are both the owners of the organization and the consumers of its output or suppliers of its input. One cannot simply assume that the members seek to maximize the profit generated by their transactions with the CU irrespective of the price and quantities of those same transactions, thus models of a financial firm based on profit maximization cannot be directly translated to a CU environment.

Second, in a CU the membership provides both the demand for and supply of loanable funds. The CU then intermediates between its member-savers and member-borrowers. This heterogeneity is an inherent source of conflict between members. Clearly, a CU cannot simultaneously maximize its dividend rate for savers and minimize its loan rate for borrowers. Since most theoretical models of cooperative enterprises assume a homogeneous member objective, they are not generally applicable to CUs.

There are two basic requirements for a framework to model CU behavior. First, the specification of the objective function should focus on the value of CU participation to the members. This value should include the prices and quantities of transactions as well as any profit that results. Second, the analysis should explicitly consider the possibility of conflict among members, and the resolution of that conflict being a preference to either the borrowers or savers.

The existing literature on CUs contains a wide variety of objective functions. Hempel and Yawitz [5] ignore the owners-are-consumers issue and simply contend that CUs, like other financial intermediaries, should maximize profit. Most writers, however, recognize that profit-maximization would be a somewhat incongruous objective for an organization that typically labels itself not-for-profit. Murray and White [9] use cost minimization subject to an output constraint. Keating [6] employs the managerial discretion approach by maximizing the manager's utility function subject to minimum member benefit constraints. Taylor [11, 12] suggests that the CU should minimize the difference between its average loan rate and savings rate paid. Smith [10] argues that the CU should

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maximize size to accommodate the desire of both its borrowers and savers. Walker and Chandler [13] introduce the concept of market rate comparison, based on the notion that the provision of savings and loan services at a price more attractive than available from alternative sources reflects the value of the CU.

The issue of borrower-versus-saver conflict has been considered by Taylor [11] and Flannery [4]. Flannery, for example, uses a simple model to show the different output decisions for four behavioral motivations: profit maximization, borrower domination, saver domination, and neutrality.

The theoretic approach introduced in this paper attempts to integrate and formalize much of this previous work, but in more flexible financial structure than usually employed. The intention is to sharpen and clarify some of the issues involved in the economic theory of a CU with a focus on regulatory policy aspects. in order to both develop a model and highlight regulatory issues, particularly in an environment of uncertainty, Section I utilizes a riskless setting. Section II draws out some of the basic regulatory issues and Section III presents the extensions that follow from introducing uncertainty to some elements of the model.

I. CU Behavior in a Riskless Setting

As a starting point, a CU objective function that depends on the value to members of their transactions with the CU is needed. The value to the borrower is represented by the difference between the CU loan rate and the best alternative market rate times the level of loan activity, that is, Net Gain on Loans (*NGL*). In a parallel manner, the Net Gain on Savings (*NGS*) can be represented by the rate difference times the level of savings.[1]

It should be emphasized that this valuation approach measures only pecuniary gain. The descriptive literature on CUs highlights the nonpecuniary benefits generated by cooperative activity. Moreover, CUs provide members with other services such as consumer education, financial counseling, group travel and insurance plans, and so on. The cost and benefit of these services can be integrated into the present framework.

The issue of saver-versus-borrower conflict can be reflected by weighting the respective contribution of *NGL* and *NGS* to the overall objective by behavioral motivation parameters λ and σ. Assume that λ and σ are scaled such that their values fall between zero and one. This will allow for specific interpretations of the objective function for borrower- and saver-oriented CUs, as well as a neutral CU when $\lambda = \sigma$. The generalized objective function is then specified to be

$$\underset{r_L, r_S}{\text{Maximize:}}\ \lambda\, NGL + \sigma\, NGS + \pi \tag{1}$$

subject to the constraints discussed below.

The decision variables are the loan rate, r_L; the dividend rate on savings (commonly called shares in CUs), r_S; and π is the operating surplus, if any, which

[1] An obvious aggregation problem is that all members do not have the same alternatives, especially on loans. This aspect is not explicitly considered in this paper, but it is possible that the "common bond" principle of CU chartering would mitigate the problem somewhat.

is available for distribution to members as an interest rebate on loans or a bonus dividend on savings.[2]

A balance sheet constraint

$$L - S = D \tag{2}$$

$L \geqq 0$, $S \geqq 0$, $D \lesseqqgtr 0$ defines the basic decision flexibility for L, the level of loans, S, the level of share deposits, and D, a debt issue if $L > S$ (for instance, borrowing from a central liquidity facility). If $L < S$, D represents a money market investment.

A nonnegative operating surplus constraint is reflected by

$$\pi = r_L L - r_S S - r_{DM} D - C_L L - C_S S - \bar{E} \geqq 0. \tag{3}$$

For simplicity, it is assumed that the exogenous rate, r_{DM}, is the same for either a debt issue ($D > 0$) or investment ($D < 0$). Average costs associated with processing loan and savings accounts are assumed to be constant at C_L and C_S. $\bar{E}$ is the sum of all fixed expenditures; for example, the rental of capital equipment and office space, and the cost of providing member services other than financial transactions. $\bar{E}$ might also include the creation of (or in a multiperiod case, the addition to) reserve accounts for contingencies, bad debts on loans, and future distribution of retained surplus.

To complete the model, we will employ linear specifications of loan demand and savings supply schedules. This will facilitate highlighting several regulating issues. Equation (4) says that the quantity of loans demanded is proportional to the spread between the CU loan rate, r_L, and the best alternative market rate, r_{LM}.

$$L = \alpha(r_{LM} - r_L), \qquad \alpha > 0 \tag{4}$$

$$S = \beta(r_S - r_{SM}), \qquad \beta > 0. \tag{5}$$

The market rates, r_{LM} and r_{SM}, are exogenously determined. These schedules will in general have nonzero slopes because individual CU members have differing search and transactions costs for choosing the location of their savings and loan activity. In essence, a more attractive rate brings more member transactions to the CU.

Substituting (4) and (5) into (2) and (3) and recalling that NGL is defined as $(r_{LM} - r_L)L$ and NGS as $(r_S - r_{SM})S$, yields a straightforward constrained optimization problem. The CU chooses the optimal loan and dividend rates, r_L^* and r_S^*, to maximize a function of the total net gain available to its membership, subject to the nonnegative surplus constraint and balance sheet constraint. For conciseness, the details of the associated Kuhn-Tucker conditions are omitted; however, four special cases provide insights into the breadth of the model's capability to reflect observed data, despite its structural simplicity. Case A examines surplus maximization, cases B and C borrower and saver domination, and case D a neutrality between borrower and saver interests.

[2] Alternatively, one could define the variables such that NGL and NGS are calculated at the effective rates (including the distribution of any surplus), then π would not appear in (1).

Case A: $\lambda = 0$, $\sigma = 0$, Maximum Surplus

This case is the natural analog to an objective function for a profit-maximizing financial intermediary. The CU would disregard the value of the transactions to the membership, instead would maximize the surplus to be distributed (or retained). The optimal rates turn out to be

$$r_L^* = \frac{r_{LM} + r_{DM} + C_L}{2} \tag{6}$$

$$r_S^* = \frac{r_{DM} + r_{SM} - C_S}{2}. \tag{7}$$

After substitution into (3), the maximum surplus is

$$\pi^* = \frac{\alpha(r_{LM} - r_{DM} - C_L)^2 + \beta(r_{DM} - r_{SM} - C_S)^2}{4} - \bar{E}. \tag{8}$$

Since $\pi^* \geqq 0$, expression (8) places a ceiling on $\bar{E}$, the expenditure on fixed costs, other member services, or retained surplus.

Case B: $\lambda = 1$, $\sigma = 0$ Complete Borrower Orientation

In general, a CU could be defined as displaying borrower orientation whenever $\lambda > \sigma$, i.e., whenever gains to borrowers carry a greater weight in the overall objective function than gains to savers. This preference is described as complete when the λ/σ ratio approaches infinity. The objective function in this case becomes the maximization of $NGL + \pi$; however, the nonnegative surplus constraint is binding so that $\pi^* = 0$. The optimal rates are:

$$r_L^* = \frac{r_{LM} + r_{DM} + C_L}{2} - \frac{r_{LM} - r_{DM} - C_L}{2}\left[1 + \frac{\beta(r_{DM} - r_{SM} - C_S)^2 - 4\bar{E}}{\alpha(r_{LM} - r_{DM} - C_L)^2}\right]^{1/2} \tag{9}$$

$$r_S^* = \frac{r_{DM} + r_{SM} - C_S}{2}. \tag{10}$$

The result for the completely borrower-oriented CU is that it sets a dividend rate as if to maximize the surplus, since (10) is the same as (7). Then it uses this "surplus" to subsidize the lowest possible loan rate and the highest level of loans consistent with break-even operations.

Case C: $\lambda = 0$, $\sigma = 1$ Complete Saver Orientation

In this case, the objective function is to maximize the gain to savers without regard to any benefit accruing to borrowers. The surplus constraint is binding (thus $\pi^* = 0$) and the optimal rates are:

$$r_L^* = \frac{r_{LM} + r_{DM} + C_L}{2} \tag{11}$$

$$r_S^* = \frac{r_{DM} + r_{SM} - C_S}{2} + \frac{r_{DM} - r_{SM} - C_S}{2} \cdot \left[1 + \frac{\alpha(r_{LM} - r_{DM} - C_L)^2 - 4\bar{E}}{\beta(r_{DM} - r_{SM} - C_S)^2}\right]^{1/2} \tag{12}$$

A saver-oriented CU sets a loan rate to maximize the surplus, then uses the surplus to permit the highest possible dividend rate and largest level of savings activity.

Case D: $\lambda = 1$, $\sigma = 1$ Equal Treatment or Neutrality

Equality or neutrality is reflected by treating an extra dollar of dividend to a saver as equivalent to an extra dollar of lower interest costs to a borrower. The CU's objective is to maximize the total gain to its borrowers and savers. Once again, the surplus constraint is binding ($\pi^* = 0$) and the optimal rates are:

$$r_L^* = \frac{r_{LM} + r_{DM} + C_L}{2} - \frac{r_{LM} - r_{DM} - C_L}{2} \cdot \left[1 - \frac{4\bar{E}}{\alpha(r_{LM} - r_{DM} - C_L)^2 + \beta(r_{DM} - r_{SM} - C_S)^2}\right]^{1/2} \tag{13}$$

$$r_S^* = \frac{r_{DM} + r_{SM} - C_S}{2} + \frac{r_{DM} - r_{SM} - C_S}{2} \cdot \left[1 - \frac{4\bar{E}}{\alpha(r_{LM} - r_{DM} - C_L)^2 + \beta(r_{DM} - r_{SM} - C_S)^2}\right]^{1/2} \tag{14}$$

Notice that in each of these cases, if $\bar{E}$ is set to its maximum amount as determined by (8), the optimal rates reduce to the surplus maximizing rates (6) and (7). In general, for any given level of $\bar{E}$, the loan rate for a borrower- (saver-) oriented CU will be less (more) than for the equal treatment case, and the dividend rate on savings will be less (more).

The decision whether to issue debt or to invest the extra funds depends entirely on the exogenous market rates, the demand and supply parameters, and the behavioral motivation of the CU. For the equal treatment case, the rule is:

$$D \gtreqless 0 \quad \text{iff} \quad \frac{\alpha(r_{LM} - C_L) + \beta(r_{SM} + C_S)}{\alpha + \beta} \gtreqless r_{DM}. \tag{15}$$

In general, a borrower- (saver-) oriented CU will issue more (less) debt or invest less (more) than if equal treatment were the case.

While these results describe the decisions that a CU would make if it acted to give preference to either its borrowers or savers, there are some reasons to believe that a CU would usually seek to maximize total net gain, i.e., the equal treatment case. First, equal weighting of gains to borrowers and savers is consistent with the "fairness" and "equity" considerations that lie behind much of cooperative philosophy. Second, a CU is a democratically controlled organization following the principle of one member—one vote. If the membership is equally distributed between savers and borrowers, equal treatment might be the reasonable compromise in the decision-making process. Moreover, borrowers or savers might hesitate to actively participate in a CU that intentionally "penalizes" their interests. Third, individual members might switch in their role as net borrowers or net savers. That is, a mainly saving member might derive benefit from access to a low-cost loan when and if the need arises. Thus, the borrower-saver conflict weakens in nature if the groups tend to overlap over time (or random switching is introduced).

II. Regulatory Issues

CUs, like all financial institutions, face a myriad of regulations. Without doubt the most important ones are rate restrictions in the form of a maximum allowable dividend and the loan rate. The effect of introducing these regulations on the theoretical framework can be illustrated in figure 1.

First, the choice set open to the CU can be constructed by substituting (4) and (5) into (3). This defines the equation of an ellipse for the binding surplus constraint, $\pi = 0$:

$$\alpha\left[r_L - \frac{r_{LM} + r_{DM} + C_L}{2}\right]^2 + \beta\left[r_S - \frac{r_{DM} + r_{SM} - C_S}{2}\right]^2 = \frac{\alpha(r_{LM} - r_{DM} - C_S)^2 + \beta(r_{DM} - r_{SM} - C_S)^2}{4} - \bar{E}. \quad (16)$$

Then for each possible level of $\bar{E}$, limited according to (8), there is a particular ellipse (with the $\bar{E} = 0$ ellipse defining the perimeter of the choice set). Points A, B, C, D correspond to the optimal rates for each of the four cases. Segment ABD represents relative borrower orientation and ACD relative saver orientation. In general, the southeast quarter of the ellipse contains all of the "efficient" rate choices.

Now suppose that the regulatory agency imposes rate restrictions reg r_L and reg r_S. Since these are both maximum conditions on the rates, the basic impact is to place a ceiling on NGS and a floor under NGL. In figure 1, the rate

Effect of Rate Restrictions

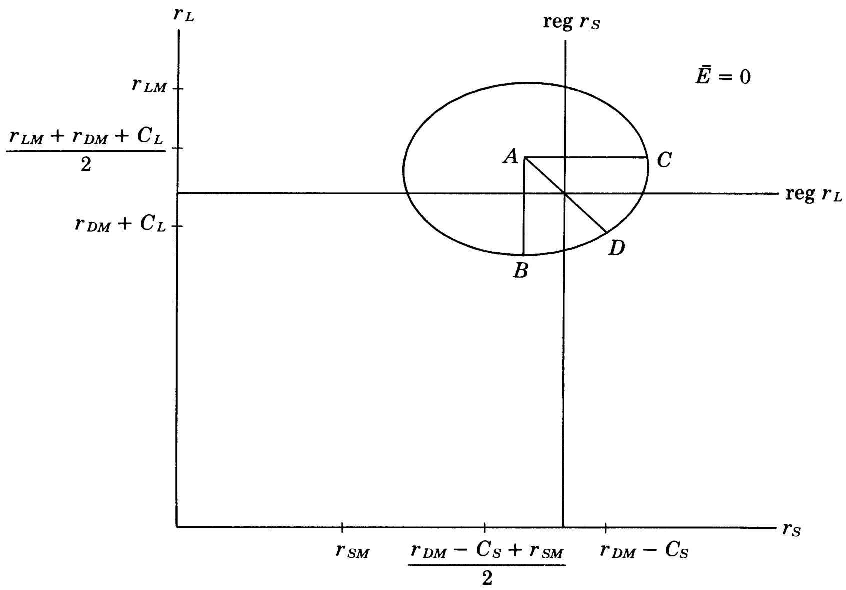

Figure 1

restrictions are drawn such that they are binding on a saver-oriented CU, since all of segment ACD is excluded from the regulation constrained choice set. The CU is effectively limited to a borrower preference position. It is here that the role of $\bar{E}$ in the model is important.

Suppose that the CU is inclined to be saver oriented or even equal treatment preferring in a regulation-free environment $\bar{E} = 0$, that is, rate pairs at points D or C. Given the imposition of the regulations, this CU might prefer to increase $\bar{E}$ rather than to further lower the loan rate such as to point B. Therefore, the CU might incur more fixed costs, or offer other member services such as investment and tax counseling, or increase reserves more than would otherwise be warranted.

While subject to rate limitations, CUs presently receive exemption from federal profit taxes. It is argued that, in the spirit of horizontal equity, if CUs are allowed extended asset and liability powers to compete more directly with other financial intermediaries, they should also face the same set of tax rules. There is an obvious problem with profit taxation of cooperative enterprises. In an ordinary firm, the profit is simply the residual income and can be appropriated by the owners of the firm. In a CU, the surplus belongs to the membership—savers and borrowers alike—who can only appropriate it on a patronage basis. That is the surplus is distributed pro rata as an adjustment to the original prices of transactions. Therefore, the CU's operating surplus is not conceptually equivalent to the profit of a commercial bank.

A possible way to implement taxation of CUs would be to define the retained surplus in excess of any required reserves as the tax base, since these amounts are not being used to adjust current period rates. In the theoretical framework of this paper, this retained surplus is a component of $\bar{E}$. Clearly, taxation would tend to discourage these surplus retentions. The likely result would be to increase the other aspects of $\bar{E}$, to lower loan rates, or to raise on savings deposits. Combined with the regulatory rate restrictions as depicted above, taxation might induce decisions closer to the equal treatment or borrower-oriented cases. However, in the absence of the regulatory rate ceilings, there would be no inducement for the unwarranted accumulation of reserves.

Monetary policy will affect the CU primarily through the three exogenous market rate variables—r_{SM}, r_{DM}, r_{LM}. Regulations and institutional rigidities tend to keep the alternative market rates on savings and loans relatively stable, although they do drift up and down over time with the general pattern of interest rates. The market rate on debt or money market investments, r_{DM}, will most likely experience the greatest movement. Since r_{DM} impacts importantly on the CU's decisions, and is affected by monetary policy (thus subject to short-run variability), the CU will have to anticipate its values over some relevant decision period.

Returning to the optimal CU rates developed above, it is clear that as r_{DM} goes up, both the loan rate and dividend rate for all behavioral motivations will go up. The CU will be inclined to either decrease the level of its debt issue or to increase its money market investments. Eventually, increases in r_{DM} could lead to a cutoff of all loan activity and the CU becomes essentially an "investment club," simply packaging its member savings into higher-yielding assets.

III. CU Behavior Under Uncertainty

The potentially stochastic nature of r_{DM} is a natural place to begin exploring the effect of uncertainty on the CU's optimal rates. Assume that all variables other than r_{DM} are known and stable. The problem is that during a period r_{DM} might vary, hence the final cost of the debt issue or investment income is random. If the CU made its decision on the basis of the expected value of r_{DM} alone, movement in r_{DM} from its mean will yield either a positive or negative surplus. To reduce the likelihood of a negative surplus, a risk intolerant CU might want to choose a rate structure different from one that leads to a zero expected surplus. To illustrate the potential impact, assume the CU is the equal treatment case, $\bar{E} = 0$, and that it makes money market investments ($L < S$). In comparison to case D above, the optimal rates under uncertainty conditions reduce to

$$r_L^* = \bar{r}_{DM} + C_L \tag{17}$$

$$r_S^* = \bar{r}_{DM} - C_S \tag{18}$$

where $\bar{r}_{DM}$ is the expected value of r_{DM}.

To compare results, we use the expected value $\bar{r}_{DM}$ as the appropriate certainty rate. If, during the period, r_{DM} falls below $\bar{r}_{DM}$, the CU setting rates (17) and (18) would not earn enough of its investments to cover all of its costs and would suffer a negative surplus. On the other hand, the CU should avoid exposure to this random element by choosing rates such that $L = S$, but this implies a lower total net gain. Thus, the CU can attain a higher expected value of total gain only by bearing some risk of a negative surplus.

The implications of the solution in (17) and (18) suggest a more formal introduction of the risk aspect is called for. A natural (and analytically tractable approach) is to include constraints that limit exposure to unfavorable chance occurrences. Suppose the problem is reformulated as

$$\underset{r_L,\, r_S}{\text{Maximize:}}\ NGL + NGS + E(\pi) \tag{19}$$

subject to

$$L - S = D$$

and

$$\text{Prob}(\pi < 0) \le \epsilon$$

where NGL and NGS are not random, but the surplus is random. The risk constraint, prob$(\pi < 0) \le \epsilon$, reflects the attitude of the CU toward risk. The parameter ϵ is a measure of the degree of risk tolerance.

Since $\pi = (r_L - C_L)L - (r_S + C_S)S - r_{DM}(L - S)$ from (3), for $L < S$ the risk constraint can be rewritten

$$\text{Prob}(r_{DM} < \bar{r}) \le \epsilon, \tag{20}$$

where

$$\bar{r} = \frac{(r_L - C_L)L - (r_S + C_S)S}{L - S}. \tag{21}$$

One can interpret $\bar{r}$ as a "risk-adjusted" return on money market investments.

Once $\bar{r}$ is determined,[3] equation (21) becomes the constraint in the optimization problem. The optimal rates are then

$$r_L^* = \frac{r_{LM} + \bar{r} + C_L}{2} - \frac{r_{LM} - \bar{r}_{DM} - C_L}{2} W \tag{22}$$

$$r_S^* = \frac{\bar{r} + r_{SM} - C_S}{2} + \frac{\bar{r}_{DM} - r_{SM} - C_S}{2} W \tag{23}$$

where

$$W = \left[\frac{\alpha(r_{LM} - \bar{r} - C_L)^2 + \beta(\bar{r} - r_{SM} - C_S)^2}{\alpha(r_{LM} - \bar{r}_{DM} - C_L)^2 + \beta(\bar{r}_{DM} - r_{SM} - C_S)^2}\right]^{1/2} \tag{24}$$

To interpret these rates, notice that $W < 1$ if and only if

$$\frac{\alpha(r_{LM} - C_L) + \beta(r_{SM} + C_S)}{\alpha + \beta} < \frac{\bar{r}_{DM} + \bar{r}}{2}. \tag{25}$$

This parallels (15) which gives the condition when an equal treatment CU will issue debt or make investments in the certainty case. Equation (25) is useful since $W < 1$ is a sufficient condition for the expected surplus to be positive. To show this, substitute (22) and (23) into $E(\pi) = (r_L - C_L - \bar{R}_{DM})L^* + (\bar{r}_{DM} - r_S - C_S)S^*$, where L^* and S^* are the levels of loans and shares at the optimal rates. Then after some rearranging

$$E(\pi) = \frac{r_{LM} - \bar{r}_{DM} - C_L}{2}(1 - W)L^* + \frac{\bar{r}_{DM} - r_{SM} - C_S}{2} \cdot (1 - W)S^* + \frac{\bar{r}_{DM} - \bar{r}}{2}(S^* - L^*). \tag{26}$$

The third term is positive since we have assumed $L^* < S^*$ and, for limited risk tolerance, $\bar{r} < \bar{r}_{DM}$.

Notice that the difference between $\bar{r}$, the risk-adjusted rate, and $\bar{r}_{DM}$, the expected value, depends on the CU's tolerance for risk and the variance of r_{DM}. In general, the less risk the CU is willing to bear or the greater the variance in r_{DM}, the higher the expected surplus. If the CU is "risk neutral" or if r_{DM} is nonrandom, then $\bar{r} = \bar{r}_{DM}$, $W = 1$, and the optimal rates in (22) and (23) simply reduce to the certainty results.

The principal result of this introduction of uncertainty into the theoretical framework is that when the income statement contains stochastic elements, the CU will not necessarily choose rates that leak to an expected break-even result. An intolerance to risk will result in positive expected surpluses. A CU might want to keep retained surplus to serve as a cushion if there is a temporary shortfall in income, for instance during a company layoff or employee strike. The possibility of taxation on the retained surplus is then important since it will affect the CU's

[3] To determine $\bar{r}$, the CU would need a (subjective) distribution function for r_{DM} and choose a value for parameter ϵ. If the density function for r_{DM} is symmetric about its mean, then it is clear that for $L < S$, $\epsilon < ½$ implies $\bar{r} < \bar{r}_{DM}$. Likewise if $L > S$, $\epsilon < ½$ implies $\bar{r} > \bar{r}_{DM}$. In this context $\epsilon < ½$ is consistent with the notion of limited risk tolerance.

attitude toward risk. In other words, the parameter ϵ would be a function of the level of retained surplus in addition to a more basic attitude toward risk. If taxation reduces the retention of surplus to act as a risk hedge, then the CU would lower parameter ϵ. This increases the spread between $\bar{r}$ and $\bar{r}_{DM}$, leading to higher expected surpluses.

IV. Conclusions

This paper has presented the basic elements of a riskless theoretical model of a credit union. In addition, part of the results based on one simple model under uncertainty were presented. Space limitations preclude presentation of the complete model under risk.

The next steps are translation of results from the theoretical framework into estimable form and developing implications based on interpretations of prior studies and new empirical evidence.

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