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DEVELOPMENT AND APPLICATION
OF COOPERATIVE THEORY AND
MEASUREMENT OF COOPERATIVE PERFORMANCE

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A MODEL OF FINANCIAL STRUCTURE IN COOPERATIVE ASSOCIATIONS

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Cooperative finance has received more attention in recent years. A cooperative is considered to be an extension of the member patrons' operation and the member-patrons have the 'obligation' to provide the needed capital. Several studies [6,8,10,12,15] and a recent report by the GAO [5] have concluded that cooperatives may be relying too heavily on member financing, or may not have the correct mix of financial instruments. Although most of these studies generally have drawn similar conclusions, the basis for the results has differed. Ladd [11] commented on the development of the objective function for the cooperative association and concluded that maximizing the present value of members' net revenues is the most appropriate objective. This paper assumes this objective and will therefore begin with a discussion of instruments available for financing the cooperative. A model for analysis is then presented which incorporates these instruments into the Ladd objective.

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COOPERATIVE FINANCIAL INSTRUMENTS

One of the distinguishing characteristics which differentiate cooperatives from proprietary corporations is that the cooperative's objective is to benefit its member-patrons whereas a proprietary corporation's objective is to benefit its owners. The net savings of a cooperative association are therefore allocated to its member-patrons on the basis of each member patron's patronage whereas proprietary corporations allocate net savings to owners based on investment. The cooperative can operate on the principle of a single tax on income produced through farmers' cooperatives by adhering to rules specified in the Internal Revenue Code for allocating the net savings to the patrons. The cooperative has a number of available decisions to make in allocating its net savings, the first being whether to operate as a 521 or non-521 cooperative. A 521 cooperative operates within the restrictions specified in section 521 of the Internal Revenue Code of 1954. A non-521 cooperative must only satisfy those restrictions specified in subchapter T of the code. Three of the more important specifications for 521 status include the allocation of patronage dividends to members and nonmembers alike, that the majority of the business be with members, and that the cooperative have no unallocated reserves. Unallocated reserves are allocations of net savings to a reserve account in the cooperative for which no specific claims are given patrons. The limitation of business [17, p. 410] done with nonmembers depends on the business nature of the cooperative. A marketing cooperative may not market more products (dollar value) for nonmembers than it does members. A supply cooperative may not supply products to nonproducers (nonfarmers) that account for more than 15 percent of all products supplied to patrons.

By satisfying the requirements of a 521 or non-521 cooperative, the cooperative may deduct from gross taxable income certain patronage allocations. The allocation which qualifies for deduction from taxable income in all cooperatives is qualified patronage dividends. An allocation is considered to be qualified if it is allocated to the patrons

and the patrons agree to pay tax on it as income in the year of the allocation. The patrons treat any portion retained by the cooperative as though it were paid in cash and reinvested. Any portion of net savings allocated as a qualified allocation must have at least 20 percent paid in cash to the patrons.

Qualified patronage dividends have been the most common type of allocation used by cooperatives. One of the fundamental advantages to using qualified allocations is that the cooperative deducts the allocation from its taxable income and the patron agrees to pay income tax on the allocation. Because of the heavy use of qualified allocations, the term has been used synonymously with patronage dividends in the literature and by some cooperative leaders. Several articles [3,7,13,14] have been published by predecessors of the Agricultural Cooperative Service to distinguish qualified allocations as only a subset of patronage dividends.

Another possible allocation of net savings for cooperatives is nonqualified patronage dividends. A patronage dividend is considered to be nonqualified if the cooperative gives written notice of the allocation to the patrons and the cooperative agrees to pay income tax on the allocation in the year it is allocated. The patron does not recognize the allocation as income in the year it is allocated and therefore pays no income tax on it then. When the cooperative pays the nonqualified allocation in cash, the patron then recognizes it as income and pays the income tax on the allocation. The cooperative's income tax for the year in which the allocation is paid in cash is the lesser of: (1) the tax for the current year after deducting the allocation from taxable income, or (2) the tax for the current year without such deduction, less the reduction in taxes which would have occurred in the prior years had the allocation been originally issued as qualified. The cooperative receives a tax refund if the reduction in the prior year's taxes is greater than the current year's tax without the deduction.

Allocating net savings as qualified or nonqualified patronage dividends allows the cooperative to operate with the principle of a

single tax on income. Allocating net savings as patronage dividends also allows the cooperative to satisfy certain other principles of cooperation. It first allows the cooperative to operate with the principle of 'service at cost' [1, p. 51], i.e., any net savings are allocated to the patrons based on the amount of net savings generated by each patron. Thus, the cooperative operates on the basis of cost to the patrons.

Second, patronage dividends allow the cooperative to satisfy what Schaars [1, p. 51] calls a fringe principle, which states that a cooperative association should be financed by the member-patrons in proportion to patronage. Because patronage dividends are allocated on the basis of patronage then any investment which accrues via patronage dividends would be based on patronage. This principle is difficult to completely satisfy since patron use is seldom static in a cooperative. It can however, allow the cooperative to approach this principle.

A 521 cooperative also qualifies certain allocations for deduction from taxable income which do not qualify in non-521 cooperatives. These allocations which qualify are (1) amounts paid as dividends on capital stock and (2) nonpatronage income allocated to patrons on a patronage basis. Nonpatronage income includes amounts received from business done with or for the U.S. Government or from nonpatronage sources such as investments.

Dividends on capital stock in a 521 cooperative must be fixed at a rate not to exceed the legal rate of interest in the State of incorporation or 8 percent per annum, whichever is greater, on the value of the consideration for which the stock was issued. The type of capital stock is not specified in the Federal statutes, however many States do restrict the type of capital stock (e.g., common, preferred, or both) which may receive a dividend and still allow the cooperative 521 status.

A non-521 cooperative is not limited in the amount of dividends on capital investment in the cooperative. The allocation to dividends on capital stock is not allowable, however, as a deduction from the taxable income of the cooperative. A non-521 cooperative may issue a dividend

on all capital investment in the firm, including all forms of capital stock and deferred patronage dividends. Another distinction for dividends on capital stock between 521 and non-521 cooperative is the way they are handled for patrons income taxes. A dividend on capital stock in non-521 cooperatives qualifies for the \$100 corporate dividend exclusion [Internal Revenue Code, section 116.a] whereas a dividend on capital stock in 521 cooperatives will not qualify [Internal Revenue Code, section 116.b].

Other financial instruments available to both 521 and non-521 cooperatives include common stock and debt. Common stock is generally sold to the membership. If a cooperative is organized as a stock corporation, membership is acquired through ownership of one or more shares of common stock. The price of the common stock is normally fixed in the articles of incorporation and the price can normally be changed only by resolution of the board of directors and/or by vote of the membership. Because of this requirement, the common stock price is normally assumed to be beyond the control of the cooperative decision maker.

Finally, debt is available to both 521 and non-521 cooperatives as a financial source. Debt may be in the form of accounts payable, short-term debt, and long-term debt.

The choice for the type of cooperative (521 vs. non-521) for filing tax returns is dependent on the specific situation of the cooperative. About 65 percent of the farmer cooperatives filing returns for the tax year 1963 complied with 521 status [17, p. 363]. By 1976, only 43 percent of the farmer cooperatives operated with 521 status [9, p. 10]. The advantage some cooperatives appear to perceive in non-521 status is that nonmembers need not receive a patronage dividend. Any patronage dividends allocated to members from net savings generated by nonmembers is taxable to both the cooperative and members. The patronage dividend to members originating from nonmember business apparently qualifies for exclusion from the member's income tax within the allowable limits of the Internal Revenue Code (section 116.a) for

corporate dividends. The Internal Revenue Service Private Letter Ruling 8130,001 supports this, however the ruling is not official as yet. Dividends on capital stock and net savings which are allocated from nonpatronage income would also be considered taxable income to the non-521 cooperative and its patrons (beyond the member's corporate dividend exclusion in section 116.a of the Internal Revenue Code). The taxability of dividends on capital stock and nonpatronage income (which favors 521 cooperatives) and the handling of net savings from nonmember business (which favors non-521 cooperatives) appear to have been the crucial issues in choosing the 521 or non-521 status.

A MODEL FOR DETERMINATION OF COOPERATIVE FINANCIAL STRUCTURE

Modeling the cooperative financial structure decision in accordance with the Ladd objective of maximizing the total net revenues of the member patrons must be divided into two separate problems. A distinction must be made in the model between 521 and non-521 cooperatives. Not all cooperatives have the opportunity to qualify as a 521 cooperative and face only the decision of determining the best financial structure within the regulations for non-521 cooperatives. A cooperative that may qualify as a 521 cooperative must determine the best financial structure from the alternatives available to both 521 and non-521 cooperatives. This should not imply that the process for qualifying as a 521 cooperative is easy. Qualification is not easy and, in fact, is considered to be a decision of long-term consequences. A cooperative must determine the status to operate in, 521 or non-521, and consider this to be a long-run decision. A dichotomy must be made with the model, however, to account for the decision facing both kinds of cooperatives.

The instruments available to both types of cooperatives are much the same. There is a difference in the analysis due to the effects of taxes. The instruments available to both include capital stock,

qualified deferred patronage dividends, nonqualified patronage dividends, and debt. Unallocated reserves is an additional instrument available only to non-521 cooperatives.

A Model for 521 Cooperatives

Cooperatives organized as stock corporations commonly require purchase of common stock for membership. Membership allows the patron the right to be involved in the management of the cooperative. Since the price of common stock is often fixed in the articles of incorporation and can be changed only by resolution of the board of directors and/or membership, the price of common stock will be assumed fixed (\bar{P}). The number of members (M) will be dependent on the variables which determine the profitability of the cooperative for the members. The membership function will not be specified except to note that membership is not necessarily fixed. It is assumed most cooperatives limit ownership of common stock to one share per member. This would satisfy the principle of cooperation stated by the Rochdale Society [1, p. 48], which promoted the cooperative principle of one member, one vote. Given this assumption, the contribution of common stock (CS) to the financial structure may be written as

$$1) \quad CS = \bar{P} \cdot M.$$

The other forms of member equity (deferred qualified and nonqualified patronage dividends) are derived from the net savings of the cooperatives. Net savings in 521 cooperatives are allocated to dividends on capital stock, qualified patronage dividends, and nonqualified patronage dividends. Net savings (NS) can be written as an identity for this distribution, i.e.,

$$2) \quad NS = DS + QPD + NPD$$

where DS is the dividends on capital stock, QPD is allocation of qualified patronage dividends, and NPD is the nonqualified patronage dividend.

The capital supplied by qualified patronage dividends each year (KQP) depends on the proportion paid in cash (defined as s) to the patron, i.e.,

$$3) KQP = (1-s)QPD.$$

Assuming τ_1 number of years deferment for qualified patronage dividends and no expected change in the exogenous variables, we may define the capital supplied via qualified patronage dividends (TKQP) as

$$4) TKQP = \tau_1 (1-s)(QPD).$$

The 521 cooperative pays taxes on the portion of net savings allocated to patrons as nonqualified patronage dividends, i.e., the capital supplied by nonqualified patronage dividends each year (KNP) is

$$5) KNP = NPD - T$$

The average tax rate for the cooperative can be specified as t_c , i.e., equation (5) may be rewritten as

$$6) KNP = NPD - t_c (NPD)$$

or

$$7) KNP = (1-t_c) NPD$$

Assuming τ_2 number of years deferment for payment of nonqualified patronage dividends and no expected change in the exogenous variables, we may define the total capital supplied via nonqualified patronage dividends (TKNP) as

$$8) TKNP = \tau_2(1-t_c) NPD.$$

The total capital employed by the cooperative is the sum of equations (1), (4), and (8), and debt (D), i.e., total capital (K) employed may be written as

$$9) K = \bar{P}M + \tau_1 (1-s)QPD + \tau_2(1-t_c)NPD + D$$

In our analysis here, capital will be assumed as fixed (\bar{K}). This is an assumption made primarily for pedagogical purposes. Other analyses have been completed in which the amount of capital is variable [18].

The capital stock that qualifies for dividends in 521 cooperatives includes common stock, deferred qualified patronage dividends, and nonqualified patronage dividends. The cooperative is not restricted to paying the same dividend on each capital source, however, the cooperative must treat members and nonmembers alike in each one of these capital classes. The capital stock the patrons hold in membership (common) stock is equivalent to CS in Equation (1). The capital stock

the patrons hold in deferred qualified patronage dividends is equivalent to TKQP in Equation (4). The total capital stock the patrons hold in nonqualified patronage dividends (PANK) includes the portion the cooperative pays in taxes, i.e.,

$$10) \text{ PANK} = \tau_2 \text{ NPD.}$$

The dividends on common stock may be defined as

$$11) \text{ DS} = i_c \bar{P}_M + i_Q \tau_1 (1-s) \text{QPD} + i_n \tau_2 \text{NPD}$$

where i_c is the dividend rate on common stock, i_Q is the dividend rate on qualified patronage dividend stock, and i_n is the dividend rate on nonqualified patronage dividend stock.

The objective for the cooperative was stated to be maximizing the total net revenues of the member patrons and may be defined as

$$12) \pi_1 = \bar{T}_m + \text{PVPD}_m + \text{DS}_m.$$

In equation (12), \bar{T}_m is the members total net revenues for the products the member patrons trade inside and outside the cooperative association, PVPD_m is the members' present value of patronage dividends, and DS_m is the dividends on the members capital stock.

Net savings were previously defined in Equation (2) for distribution purposes. Net savings can alternatively be defined as to their source of origination. They may be defined for this purpose as equal to the operating income of the cooperative (θ) less the interest cost of debt, i.e.,

$$13) \text{ NS} = \theta - rD.$$

Operating income (θ) can be defined as the income generated from the normal operations of the cooperative business operation excluding interest cost. In equation (13) r represents the average interest rate of debt.

The net operating income (θ) affects the pricing decisions of the cooperative, and therefore \bar{T}_m . The cooperative decision maker may determine the level of θ . Varying θ will affect the financial structure of the cooperative because of the effect on \bar{T}_m and net savings. Net savings is not a free good and should not be considered as such. An upper limit, where patrons receive no payment for products marketed by

the cooperative and the patrons pay market price for products the cooperative purchases for them, could be specified as θ_u and a lower limit could be specified as 0.

The revenues members realize for products traded inside and outside the cooperative may be specified as

$$14) \quad \bar{T}_m = T(\theta).$$

PVPD_m may be defined as

$$15) \quad \text{PVPD}_m = \rho \left\{ \left[s + \frac{(1-s)}{(1+d)^{\tau_1}} - t_m \right] \text{QPD} + \left[\frac{(1-t_m)}{(1+d)^{\tau_2}} \right] \text{NPD} \right\}$$

where ρ is the proportion of net savings generated by members, s is the proportion of qualified patronage dividends paid in cash, $(1-s)$ is the deferred proportion of qualified patronage dividends deferred for cash payment in τ_1 years, d is the average discount rate of the membership, t_m is the average tax rate for the membership, and τ_2 is the period of deferment for payment of the nonqualified patronage dividends. Dividends on members' capital stock is taxable to the members, i.e., the net dividends on the members capital stock may be stated as

$$16) \quad \text{DS}_m = \{ i_c \bar{\text{PM}} + \rho [i_Q \tau_1 (1-s) \text{QPD} + i_n \tau_2 \text{NPD}] \} (1-t_m)$$

The objective function of the 521 cooperative may be rewritten by substituting equations (14), (15), and (16) into equation (12) and rearranging, i.e.,

$$17) \quad \pi_1 = (1-t_m) T(\theta) + \rho \left\{ \left[s + \frac{(1-s)}{(1+d)^{\tau_1}} - t_m \right] \text{QPD} + \left[\frac{(1-t_m)}{(1+d)^{\tau_2}} \right] \text{NPD} \right\} \\ + (1-t_m) \rho \{ i_Q [\tau_1 (1-s) \text{QPD}] + i_n [\tau_2 \text{NPD}] \} + i_c \bar{\text{PM}} .$$

The objective function should be maximized subject to the constraints the 521 cooperative faces. The first constraint is the specification that the cooperative will employ \bar{K} amount of capital, i.e., equation

(9). The second and third constraints specify that the proportion of qualified patronage dividends paid in cash will be greater than or equal to 20 percent but less than or equal to 100 percent, i.e.,

$$18) s \geq 0.2$$

$$19) 1.0 \geq s.$$

These constraints come from the regulations governing cooperatives.

The fourth through sixth constraints limit the dividend rates on the capital stock. 521 cooperatives cannot exceed 8 percent per annum or that specified by State regulations, whichever is greater. This upper limit varies State to State and is specified here as \bar{i} , i.e.,

$$20) \bar{i} \geq i_c$$

$$21) \bar{i} \geq i_q$$

$$22) \bar{i} \geq i_n.$$

The seventh constraint specifies that net savings must be allocated. Substituting equation (11) for DS and equation (13) for NS into equation (2), the constraint can be written as

$$23) \theta - rD - i_c PM - i_q \tau_1 (1-s) QPD - i_n \tau_2 NPD - QPD - NPD = 0.$$

Finally, the upper limit for θ must be specified as a constraint, i.e.,

$$24) \theta_u > \theta$$

Given equation (17) as the objective function for the 521 cooperative and equations (9) and (18) through (24) for constraints, the Lagrangean function for the 521 cooperative may be stated as

$$\begin{aligned}
25) \quad L_1 = & T(\theta) + \rho \left\{ \left[s + \frac{(1-s)}{\tau_1} - t_m \right] QPD + \left[\frac{(1-t_m)}{(1+d)^{\tau_2}} \right] NPD \right\} \\
& + (1-t_m) \rho \{ i_Q [\tau_1(1-s)QPD] + i_n [\tau_2 NPD] \} + i_c \bar{P}M \\
& + \lambda_1 [\bar{K} - \bar{P}M - \tau_1(1-s)QPD - \tau_2(1-t_c)NPD - D] \\
& + \lambda_2 [s - 0.2] + \lambda_3 [1.0 - s] \\
& + \lambda_4 [\bar{i} - i_c] + \lambda_5 [\bar{i} - i_Q] + \lambda_6 [\bar{i} - i_n] \\
& + \lambda_7 [\theta - rD - i_c \bar{P}M - i_Q \tau_1(1-s)QPD - i_n \tau_2 NPD - QPD - NPD] \\
& + \lambda_8 [\theta_u - \theta]
\end{aligned}$$

The decision variables available to the cooperative decision maker include: the proportion of qualified patronage dividends to pay in cash (s); the length of the revolving fund for qualified patronage dividends (τ_1); the length of the revolving fund for nonqualified patronage dividends (τ_2); the level of net operating income (θ); the dividend rates on the various capital sources (i_c, i_Q, i_n); the amount of net savings allocated as qualified patronage dividends (QPD); the amount of net savings allocated as nonqualified patronage dividends (NPD); and the amount of debt to employ (D).

A Model for Non-521 Cooperatives

The model of the non-521 cooperative is much more difficult to develop because of the additional alternatives available to non-521 cooperatives. Non-521 cooperatives may declare a dividend on capital stock which both members and nonmembers hold, and also differentiate the

dividend rate between members and nonmembers. Non-521 cooperatives may also differentiate the allocation of patronage dividends between members and nonmembers, i.e., the cooperative may allocate any or all net savings generated by nonmembers to members.

The same assumptions made concerning common stock in 521 cooperatives will also be made in non-521 cooperatives, i.e., the price of common stock is fixed (\bar{P}) and ownership is limited to one share per member. The common stock investment in non-521 cooperatives is therefore equivalent to equation (1). Other forms of patron equity (both member and nonmember, qualified and nonqualified patronage dividends) are derived from net savings of the cooperative. The distribution of net savings in non-521 cooperatives is equivalent to that in equation (2), however more may be learned by distinguishing between the members and nonmembers dividends on capital stock, i.e.,

$$26) \quad NS = DS_{m1} + DS_{n1} + QPD + NPD$$

where the variables DS , QPD , and NPD are dividends on capital stock, qualified patronage dividends, and nonqualified patronage dividends, respectively, and the subscripts $m1$ and $n1$ refer to the allocation to members and nonmembers, respectively.

The capital supplied by qualified patronage dividends depends on the portion paid in cash and the allocation between members and nonmembers. The cooperative may choose to give nonmembers only a portion of the net savings generated by nonmembers. If members receive an allocation of net savings generated by nonmembers, then this allocation is taxable to both the member patrons and cooperative. We can define the capital supplied each year by members via qualified patronage dividends as KQP_m , i.e.,

$$27) \quad KQP_m = [\rho + (1-\rho) A(1-t_c)] (1-s)QPD.$$

In equation (27) ρ refers to the proportion of net savings generated by member patrons, A refers to the proportion of net savings generated by nonmember patrons and allocated to member patrons, t_c is the cooperative's average tax rate, s is the proportion qualified patronage dividends allocated as cash, and QPD is the amount of allocated qualified patronage dividends.

The amount of capital supplied by nonmembers each year via qualified patronage dividends (KQP_n) is dependent on s , A , ρ , and QPD , i.e.,

$$28) KQP_n = (1-A)(1-\rho)(1-s)QPD.$$

Note that if nonmembers receive an allocation of qualified patronage dividends from net savings generated by nonmembers, then the cooperative is not taxed on that allocation. It is assumed that the cooperative would not proportionally allocate more qualified patronage dividends to nonmembers than the proportional amount of net savings generated by nonmembers ($1-\rho$). This implies that A has a range of 0 to 1.0.

The total amount of capital supplied by qualified patronage dividends ($TKQP_2$) may be specified as the sum of equations (27) and (28) multiplied by the number of years deferred qualified patronage dividends are held by the cooperative (τ_1), i.e.,

$$29) TKQP_2 = \tau_1 \{ [\rho + (1-\rho)A(1-t_c)](1-s)QPD \\ + (1-A)(1-\rho)(1-s)QPD \}$$

The capital supplied by nonqualified patronage dividends depends on the tax rate of the cooperative, i.e., the annual contribution of members nonqualified patronage dividends (KNP_m) may be written as

$$30) KNP_m = (1-t_c)[\rho + (1-\rho)A]NPD$$

and the nonmembers contribution of nonqualified patronage dividends (KNP_n) may be written as

$$31) KNP_n = (1-t_c)(1-\rho)(1-A)NPD.$$

The total amount of capital supplied by nonqualified patronage dividends ($TKNP_2$) equals the sum of equations (30) and (31) multiplied by the number of years nonqualified patronage dividends are held by the cooperative. By rearranging this product we can find $TKNP_2$ to be

$$32) TKNP_2 = \tau_2 (1-t_c)NPD.$$

The total capital employed by the cooperative is the sum of equations (1), (29), (32), and debt (D), i.e., total capital employed (K) may be written as

$$33) K = PM + \tau_1 \{ [\rho + (1-\rho)A(1-t_c) + (1-A)(1-\rho)] (1-s)QPD \} \\ + \tau_2 (1-t_c)NPD + D.$$

In this analysis capital is again assumed to be fixed (\bar{K}).

Non-521 cooperatives may declare a dividend on all capital stock supplied by patrons and may distinguish the dividend rate between members and nonmembers, and, common stock, qualified patronage dividend stock, and nonqualified patronage dividend stock. Note that the nonqualified patronage dividend stock member patrons hold ($MKNP_m$) is equation (30) plus the tax the cooperative pays on the members' allocation for the share which the member generated. The tax is the annual contribution ($t_c \cdot P \cdot NPD$) multiplied by the deferment period, τ_2 , i.e.,

$$34) \quad MKNP_m = [\rho + (1-t_c)(1-\rho)A]\tau_2 NPD.$$

The dividends on capital stock to members may be written as

$$35) \quad DS_{m1} = i_{c1} \bar{P}M + i_{Q1} \{[\rho + (1-\rho)A(1-t_c)]\tau_1(1-s)QPD\} \\ + i_{n1} \{[\rho + (1-t_c)(1-\rho)A]\tau_2 NPD\} (1-t_c)$$

where i_{c1} is the dividend rate on common stock (equation (1)), i_{Q1} is the dividend rate on members' qualified patronage dividend stock (the total stock here equals equation (27) multiplied by τ_1), and i_{n1} is the dividend rate on members' nonqualified patronage dividend stock (equation (34)). The net dividends on capital stock realized by members (NDS_m) is equation (35) multiplied by $(1-t_m)$. This is because the dividends on capital stock are taxable to both patrons and the non-521 cooperatives, i.e.,

$$36) \quad NDS_m = (1-t_m) [i_{c1} \bar{P}M + i_{Q1} \{[\rho + (1-\rho)A(1-t_c)]\tau_1(1-s)QPD\} \\ + i_{n1} \{[\rho + (1-t_c)(1-\rho)A]\tau_2 NPD\} (1-t_c)]$$

Nonmember patrons may hold capital stock in the form of deferred qualified patronage dividends and nonqualified patronage dividends. The

dividend rate on this capital stock can be differentiated from that rate paid to members. The investment of nonmembers via qualified patronage dividends equals equation (28) multiplied by the number of years deferment for deferred qualified patronage dividends (τ_1). The investment of capital nonmembers held in nonqualified patronage dividend stock ($MKNP_n$) equals equation (31) plus the tax the cooperative pays on the nonmembers allocations, $t_c(1-\rho)NPD$, multiplied by the period of deferment for nonqualified patronage dividends, i.e.,

$$37) \quad MKNP_n = \tau_2(1-\rho)(1-A)NPD.$$

The dividends on capital stock for nonmembers (DS_{n1}) equals

$$38) \quad DS_m = (1-t_c) \quad i_{Q2} \{ \tau_1 [(1-A)(1-\rho)(1-s)QPD] \} \\ + i_{n2} \{ \tau_2(1-\rho)(1-A)NPD \} .$$

where i_{Q2} is the dividend rate on qualified patronage dividend stock held by nonmembers and i_{n2} is the dividend rate on nonqualified patronage dividend stock held by nonmembers.

The objective for the non-521 cooperative is to maximize the total net revenues of the member patrons and may be written as,

$$39) \quad \pi_2 = \bar{T}_{m1} + PVPD_{m1} + NDS_{m1}.$$

Net savings may be defined by their source of origination as in equation (13). θ again affects \bar{T}_{m1} similarly to its effect on \bar{T}_m in equation (14). Also affecting \bar{T}_{m1} will be the proportion of net savings generated by nonmembers allocated to nonmembers by patronage dividends (A, QPD, NPD) and the dividend rate on the nonmember capital stock (i_{Q2} and i_{n2}), i.e.,

$$40) \quad \bar{T}_{m1} = T_1 (\theta, i_{Q2}, i_{n2}, A, QPD, NPD).$$

PVPD_{m1} may be defined as

$$41) \text{ PVPD}_{m1} = \rho \left\{ \left[s + \frac{(1-s)}{(1+d)^{\tau_1}} - t_m \right] \text{QPD} + \left[\frac{(1-t_m)}{(1+d)^{\tau_2}} \right] \text{NPD} \right\} \\ + (1-\rho)A(1-t_m)(1-t_c) \left\{ \left[s + \frac{(1-s)}{(1+d)^{\tau_1}} \right] \text{QPD} + \left[\frac{1}{(1+d)^{\tau_2}} \right] \text{NPD} \right\} .$$

In equation (41) d again refers to the average discount rate for the members. The first line on the right hand side of equation (41) refers to the present value of patronage dividends allocated to members from net savings generated by members. The second line in equation (41) refers to the present value of patronage dividends allocated to members from net savings generated by nonmembers. NDS_{m1} was defined in equation (36), i.e., the objective function of the non-521 cooperative may be rewritten by substituting equations (36), (40), and (41) into equation (39), i.e.,

$$42) \pi_2 = T_1(\theta, i_{Q2}, i_{n2}, A, \text{QPD}, \text{NPD}) + \rho \left\{ \left[s + \frac{(1-s)}{(1+d)^{\tau_1}} - t_m \right] \text{QPD} + \left[\frac{(1-t_m)}{(1+d)^{\tau_2}} \right] \text{NPD} \right\} \\ + (1-\rho)A(1-t_m)(1-t_c) \left\{ \left[s + \frac{(1-s)}{(1+d)^{\tau_1}} \right] \text{QPD} + \left[\frac{1}{(1+d)^{\tau_2}} \right] \text{NPD} \right\} \\ + (1-t_c)(1-t_m) i_{c1}^{\text{PM}} + i_{Q1} \{ [\rho + (1-\rho)A(1-t_c)] \tau_1 (1-s) \text{QPD} \} \\ + i_{n1} \{ [\rho + (1-t_c)(1-\rho)A] \tau_2 \text{NPD} \} .$$

The objective function should be maximized subject to the constraints the non-521 cooperative faces. The first constraint is the specification that the cooperative will employ \bar{K} amount of capital, i.e., equation (33). The second and third constraints specify that the proportion of qualified patronage dividends paid in cash will be greater than or equal to 20 percent and less than or equal to 100 percent. These are the same as the constraints specified in expressions (18) and (19).

The fourth constraint specifies that the net savings must be allocated. Substituting equation (35) for DS_{m1} , equation (38) for DS_{n1} , and equation (13) for NS into equation (26), we find

$$\begin{aligned}
 43) \quad & \theta - rD - (1-t_c) \quad i_{c1} \bar{P}M + i_{Q1} \{[\rho + (1-\rho)A(1-t_c)]\tau_1(1-s)QPD\} \\
 & + i_{n1} \{[\rho + (1-t_c)(1-\rho)A]\tau_2NPD\} \\
 & -(1-t_c) \quad i_{Q2} \{\tau_1[(1-A)(1-\rho)(1-s)QPD]\} + i_{n2} \{\tau_2(1-\rho)(1-A)NPD\} \\
 & - QPD - NPD = 0.
 \end{aligned}$$

The final constraint will specify an upper limit for θ as θ_u . θ_u however, will depend on the amount of nonmember business. Nonmember business will be influenced by $A, i_{Q2}, i_{n2}, QPD,$ and $NPD,$ i.e.,

$$44) \quad \theta_u(A, i_{Q2}, i_{n2}, QPD, NPD) - \theta \leq 0.$$

Given equation (42) as the objective function for the non-521 cooperative and expressions (33), (18), (19), (43), and (44) as constraints, the Lagrangean function for the non-521 cooperative may be expressed as

$$\begin{aligned}
45) \quad L_2 = & T_1(\theta, i_{Q1}, i_{Q2}, A, QPD, NPD) + \rho \left\{ \left[s + \frac{(1-s)}{\tau_1} - t_m \right] QPD \right. \\
& + \left[\frac{(1-t_m)}{(1+d)\tau_2} \right] NPD \left. \right\} + (1-\rho)A(1-t_m)(1-t_c) \left\{ \left[s + \frac{(1-s)}{\tau_1} \right] QPD \right. \\
& + \left[\frac{1}{(1+d)\tau_2} \right] NPD \left. \right\} + (1-t_c)(1-t_m) (i_{c1} \bar{P}M \\
& + i_{Q1} \{ [\rho + (1-\rho)A(1-t_c)] \tau_1 (1-s) QPD \} \\
& + i_{n1} \{ [\rho + (1-t_c)(1-\rho)A] \tau_2 NPD \} \\
& + \lambda_1 \bar{K} - \bar{P}M - \tau_1 \{ [\rho + (1-\rho)A(1-t_c) + A(1-\rho)] (1-s) QPD \} \\
& + \tau_2 (1-t_c) NPD + D \\
& + \lambda_2 [s - 0.2] + \lambda_3 [1.0 - s] \\
& + \lambda_4 \theta - rD - (1-t_c) i_{c1} \bar{P}M + i_{Q1} \{ [\rho + (1-\rho)A(1-t_c)] \tau_1 (1-s) QPD \} \\
& + i_{n1} \{ [\rho + (1-t_c)(1-\rho)A] \tau_2 NPD \} - (1-t_c) i_{Q2} \{ \tau_1 \\
& [(1-A)(1-\rho)(1-s) QPD] \} + i_{n2} \{ \tau_2 (1-\rho)(1-A) NPD \} \\
& - QPD - NPD \\
& + \lambda_5 [\theta_u(A, i_{Q2}, i_{n2}, QPD, NPD) - \theta] .
\end{aligned}$$

The decision variables available to the cooperative decision maker include: the proportion of qualified patronage dividends to pay in cash (s); the length of the revolving fund for qualified patronage dividends (τ_1); the length of the revolving fund for nonqualified patronage

dividends (τ_2); the level of net operating income (θ); the dividend rates on the various capital sources ($i_{c1}, i_{q1}, i_{n1}, i_{q2}, i_{n2}$); the proportion of net savings which are generated by nonmembers and allocated to members via patronage dividends (A); the amount of net savings allocated as qualified patronage dividends (QPD); the amount of net savings allocated as nonqualified patronage dividends (NPD); and the amount of debt to employ (D).

A BRIEF DISCUSSION OF THE MODELS

The models developed and stated in the Lagrangean expressions (25) and (45) point to the difficulty cooperative decision makers face in attempting to establish the best financial structure. Not recognizing all the alternatives available for financing the cooperative may cause the decision maker to err in establishing financial structure. If the cooperative decision maker recognized all of the available alternatives, his information search and decision processes would have to be cumbersome or complex. Continued research needs to be done to enable decision makers to simplify the information search and decision rules.

The models developed here account for most of the choices cooperative decision makers have for developing the financial structure. Consideration was given to possible instruments few cooperatives use, but should be considered. Declaring dividends on nonmember patronage (or equity) in non-521 cooperatives would at surface not appear to be in the best interests of members. Some cooperatives, however, may find it advantageous if the effects of the dividends are significant on the net savings of the cooperative or significant on the revenues for products members trade with the cooperative. For example, without nonmember patronage a grain marketing cooperative may not have enough volume to utilize unit train shipments for grain. If declaring dividends to nonmembers creates enough business with nonmembers to allow unit train shipments, then it is likely that the dividends have had a positive effect on the net revenues of the members.

Finally, some effects were not considered in the analysis which could be important factors in establishing cooperative financial structure. Membership was not discussed beyond the note that it should not be assumed as necessarily constant. Even if members cannot withdraw the equity invested in a cooperative when they cease active membership, the withdrawal of active membership could still have serious effects on the net revenues of the remaining active members. Cooperative decision makers must be aware of this fact and not ignore these effects.

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