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Individual Patron Preferences, Collective Choice, and Cooperative Equity Revolvment Practices

Jeffrey S. Royer and M. L. Mohamad Shihpar

This paper analyzes how the proportion of patronage refunds a cooperative pays in cash affects the cash flow of individual patrons and how an individual patron's preferences regarding patronage refunds and equity revolvment are affected by age and other factors. Using an estimated patron age distribution and a collective choice model based on the preferences of the median voter, we predict which patronage refund and equity revolvment practices should dominate under selected patron and cooperative characteristics. We also examine the role of former patrons in determining refund and revolvment practices and how outcomes may be affected by alternative voting schemes.

Farmer cooperatives generally have flexibility in choosing the proportion of patronage refunds they return to patrons in cash, and their choices can have important impacts on patron cash flows. A high cash proportion of patronage refunds can ensure that active patrons do not suffer negative cash flows due to taxes and can help a cooperative attract new business. On the other hand, by paying low cash patronage refunds, a cooperative can accelerate equity revolvment, thereby minimizing problems arising from the provision of equity by former patrons.

A cooperative's choice of the level of cash patronage refunds it pays can be complicated by the disparate preferences patrons may have regarding patronage refunds and equity revolvment. Furthermore, the preference of an individual patron can be expected to change during the course of the patron's farming career. Typically, younger patrons can be expected to prefer high cash patronage refunds at the expense of equity revolvment. However, as these patrons accumulate equity investments in the cooperative and begin approaching retirement, they may prefer lower cash refunds and more rapid equity revolvment.

This paper analyzes how the proportion of patronage refunds a cooperative chooses to pay in cash affects the cash flow of individual patrons and how an individual patron's preferences regarding patronage refunds and equity revolvment are affected by age and other factors. Using an estimated patron age distribution and a collective choice model based on the preferences of the median voter, we predict which patronage refund and equity revolvment practices should dominate under selected patron and cooperative characteristics. We also examine the role of former patrons in determining cooperative patronage refund and

Jeffrey S. Royer and M. L. Mohamad Shihpar are respectively professor and graduate research assistant, Department of Agricultural Economics, University of Nebraska-Lincoln.

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equity revolvment practices and how outcomes may be affected by alternative voting schemes.

Several articles, including Beierlein and Schrader (1978), Royer (1987, 1993), and Corman and Fulton (1990), have used the present value of the cash flows received from a cooperative as the criterion for evaluating the effects of various equity financing and redemption practices on patrons as a group. However, none has analyzed the impact that cash patronage refunds and the revolving period have on individual patrons and how individual patron preferences may shape collective choices regarding them.

Our analysis is based on the first-in/first-out revolving fund method of financing used by most cooperatives that systematically plan for the accumulation and retirement of patron equity.¹ Under the revolving fund plan, a cooperative retains a proportion of the patronage refunds it issues patrons each year. These retained patronage refunds are added to the revolving fund to provide equity capital and to be redeemed eventually in turn. The oldest equities are redeemed first, usually at the discretion of the board of directors and according to the financial needs of the cooperative.

A Model of Individual Patron Preferences

We posit that each patron will prefer any action that will increase the present value of the stream of future cash flows the patron receives from the cooperative. In order to focus exclusively on the cash flows from cash patronage refunds and the redemption of noncash patronage refund allocations, we assume that a cooperative's decisions about cash patronage refunds and the revolving period are independent of its decisions on pricing and other factors that also may affect patron cash flows. For simplicity, the analysis in this section is conducted on a before-tax basis. Because a patron generally is required to include both the cash and noncash portions of a patronage refund distribution in taxable income, taxes are neutral in their impact on this analysis. Analysis in subsequent sections will be conducted on an after-tax basis to illustrate the potential cash drains from taxes.

Consider the effect on an individual patron of a once-and-for-all shift in the proportion of patronage refunds a cooperative pays in cash. Let n represent the current year, R the last year of the patron's farming career, and T the current length of the revolving period. Then PV_n , the present value in year n of the patron's stream of future cash flows, is the sum of the present value of future cash and noncash patronage refunds from the end of year n through year R plus the discounted value of noncash patronage refunds currently in the revolving fund, i.e., noncash patronage refunds allocated during the past T years:

$$PV_n = \sum_{t=n}^R \left[\frac{c}{(1+d)^{t-n}} + \frac{1-c}{(1+d)^{t+T_i-n}} \right] PR_t + \sum_{t=n-T}^{n-1} \frac{NCPR_t}{(1+d)^{t+T_i-n}} \quad (1)$$

where c is the proportion of patronage refunds the cooperative pays in cash, d is the patron's discount rate, PR_t is patronage refunds allocated in year t in the future ($t \geq n$), and $NCPR_t$ is noncash patronage refunds allocated in year t in the past ($t < n$). T_i represents the amount of time during which patronage refunds allocated in year t are held in the revolving fund. If the fund is in a steady state, T_i for any year t will equal T , the current length of the revolving period. However, if there

are significant changes in the variable c or any parameter, T_t for any year t can be expected to diverge from T .

The derivative of the present value in (1) with respect to c is:

$$\frac{dPV_n}{dc} = \sum_{t=n}^R \frac{PR_t}{(1+d)^{t-n}} - \sum_{t=n}^R \frac{PR_t}{(1+d)^{t+T_t-n}} - \sum_{t=n}^R \ln(1+d) \frac{(1-c)PR_t}{(1+d)^{t+T_t-n}} \frac{dT_t}{dc} - \sum_{t=n-T}^{n-1} \ln(1+d) \frac{NCPR_t}{(1+d)^{t+T_t-n}} \frac{dT_t}{dc} \quad (2)$$

Respectively, the four terms on the right-hand side of (2) are: (a) the increase in the present value of future cash patronage refunds due to the increase in the proportion of patronage refunds paid in cash, (b) the associated decrease in the present value of future noncash patronage refunds, (c) the decrease in the present value of future noncash patronage refunds due to increases in the length of the revolving period, and (d) the decrease in the present value of noncash patronage refunds currently in the revolving fund due to increases in the length of the revolving period.

An increase in the proportion of patronage refunds the cooperative pays in cash will increase the present value of the patron's future cash flow if the first effect exceeds the sum of the other three effects. The signs of the cross partial derivatives generally are ambiguous. In addition, there are nonlinearities in the effects changes in the proportion of cash patronage refunds, the growth rate of the revolving fund, and the rate of return to revolving equity have on the length of the revolving period. Consequently, an analysis of the impact of patronage refund and equity revolvment practices on patron cash flows must be based on simulation methods rather than comparative statics.

Empirical Procedures

Following Barton and Schmidt (1988), we assumed that the patronage refunds earned by a patron are proportionate to farm sales, and we estimated the sales of a representative patron for each year of the patron's farming career from their data on the 1986 crop and livestock sales of 2,215 Kansas farm operators with sales of less than \$3 million. We also estimated the distribution of patrons by age necessary for the collective choice analysis. In the regression models, which are reported in table 1, sales per farmer and the number of farmers in each one-year age category were expressed as quadratic functions of age. The purpose of the

TABLE 1. Sales per Farmer and Number of Farmers as Quadratic Functions of Age

	Sales per farmer	Number of farmers
Constant	-161,800 (-3.8898)	-107.38 (-10.703)
AGE	13,402 (7.4958)	6.6912 (15.515)
AGE ²	-131.3 (-7.5157)	-.067754 (-16.078)
F	28.361	131.641
R ²	.4818	.8119

Note: Figures within parentheses represent t values. Both models and all coefficients are significant at the $\alpha=.001$ level.

regressions was to relate patronage refunds and membership to age rather than to explain variation in the data. Although the first model explains less than half the variation, both models and all parameter estimates are highly significant.²

The age distribution estimated by the regression model was modified by rounding the number of patrons in each age category to the nearest integer. In addition, the ends of both the sales function and the age distribution were truncated to eliminate negative sales values predicted for the youngest and oldest farmers. The descriptive statistics for the resulting functions, which range from 21 to 78 years of age, are essentially equivalent to those for the sample data. In particular, the lower quartile, median, and upper quartile statistics for the age distribution are identical to those for the sample at 39, 49, and 59 years.

Analyses were conducted using a computer program based on the growth model of a cooperative described in Royer 1993. The program simulates the operation of a revolving fund given annual input about the cooperative's earnings and decisions on cash patronage refunds and growth.³ The after-tax cash flows of individual patrons were calculated according to the length of the revolving period determined by the simulation model and the sales function estimated from the Barton and Schmidt data.

To provide benchmark comparisons for the simulation results, a set of baseline parameter values were selected. The baseline values are patron marginal personal income tax rate=.28, patron discount rate=.10, cooperative rate of return to revolving equity=.15, and cooperative rate of growth in equity=.075. The baseline rates of return and growth are consistent with those experienced by U.S. farmer cooperatives during the period 1970 to 1987 (Royer 1993). Because taxes are neutral in this analysis, the choice of a baseline tax rate was fairly arbitrary.

Representative Patron Cash Flows

The effect a cooperative's choices regarding cash patronage refunds and equity revolvment may have on an individual patron can be demonstrated by comparing the cash flows a representative patron would receive under two different plans. Under one plan, the cooperative pays the 20 percent minimum cash patronage refunds required for deducting the refunds from its taxable income, and it is able to maintain a revolving period of 14 years given the baseline parameter values. Under the other plan, the cooperative pays 45 percent cash patronage refunds and is able to maintain a 34-year revolving period. The proportion of cash patronage refunds in the second plan was set at 45 percent to avoid the extremely long revolving periods associated with higher proportions. Given the baseline parameter values, the length of the revolving period approaches infinity, i.e., equity ceases to revolve, as the proportion of cash patronage refunds nears 50 percent (see Royer 1993).⁴

The nominal and present values of the representative patron's after-tax cash flows are represented in figures 1 and 2. The cash flows extend throughout the patron's farming career and continue after the patron retires from farming—until the cooperative redeems the last of the patron's noncash patronage refund allocations in the revolving fund. The patron's farming career and the patronage refunds the patron receives from the cooperative are based on the sales function and age distribution shown in table 1. Patronage refunds were related to the sales function by arbitrarily setting the first year's refund to \$100.

FIGURE 1. Nominal Values of Representative Patron's After-Tax Cash Flows

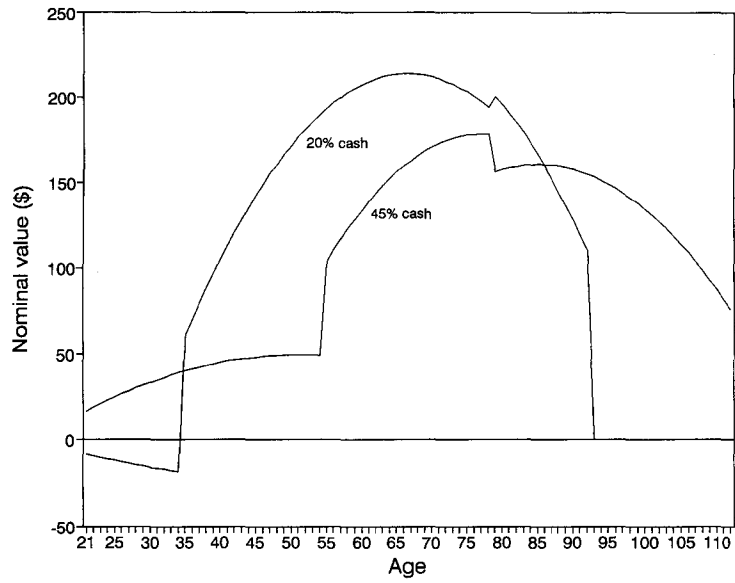
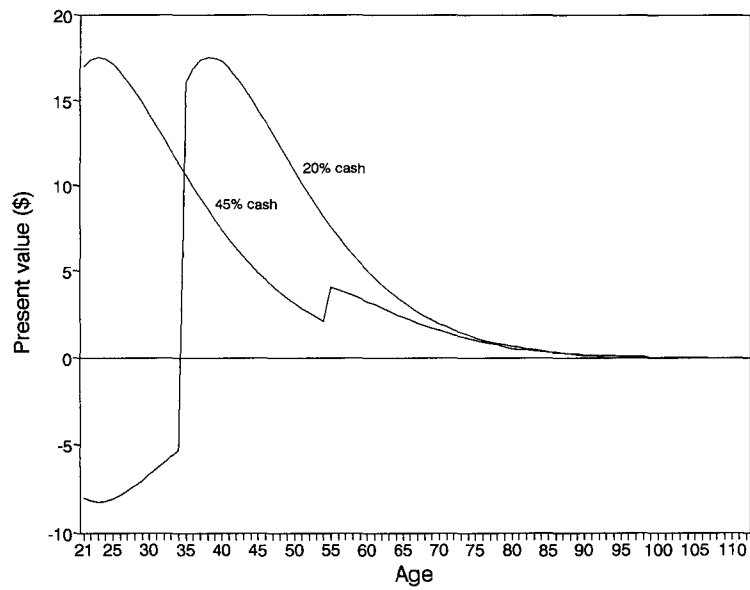


FIGURE 2. Present Values of Representative Patron's After-Tax Cash Flows



Additional information about patronage refunds, income tax, and the revolving period is presented in table 2, where the representative patron's association with the cooperative is separated into three periods: (a) the *investment period*, during which the patron invests equity into the cooperative through retained patronage refunds but receives no cash from the revolvment of equity, (b) the *active period*, during which the patron continues to invest noncash patronage refunds while participating in equity revolvment, and (c) the *disinvestment period*, during which the patron no longer receives patronage refunds and the patron's cash flow consists entirely of the revolvment of equity earned earlier. The length of these periods is different under the two plans because of the length of the respective revolving cycles.

If the cooperative pays 20 percent of its patronage refunds in cash, the cash portion received by the patron is insufficient for covering income tax during the investment period, and the patron experiences net cash drains from the cooperative. In contrast, if the cooperative pays 45 percent cash patronage refunds, patron after-tax cash flow is positive during the investment period, which is extended because of a longer revolving cycle. During the active period, the redemption of earlier equity allocations offsets the tax drain on current patronage refunds under the 20 percent plan, and the cash flow exceeds that of the 45 percent plan for the rest of the patron's farming career. The disinvestment period begins when the patron retires from farming at age 79. During the first several years of this period, cash flow is greater under the 20 percent plan. Eventually, however, cash flow under the 20 percent plan diminishes as the cooperative begins revolving equity earned during the waning years of the patron's farming career.

The present value of the representative patron's total after-tax cash flow is greater under the 45 percent plan, as is the present value of the annual cash flows for the first 14 years. Thus, based on the present value criterion, the representative patron would begin farming with a preference for receiving 45 percent cash patronage refunds. However, at some point, as the patron's farming career progresses and the patron's equity investment in the cooperative accumulates, the patron would prefer that the cooperative begin paying a smaller proportion of patronage refunds in cash in order to accelerate equity revolvment. Simulations using the baseline parameter values indicate that the present value of the representative patron's after-tax cash flow would be greatest if the cooperative were to pay 45 percent cash patronage refunds at the beginning of the patron's farming career and shift to paying 20 percent cash patronage refunds when the patron turns 43 years old.

Generally, the age at which a patron would favor a shift to lower cash patronage refunds and accelerated equity revolvment depends on several factors, including the patron's discount rate as well as the cooperative's rate of return to equity and its growth rate, two factors that affect the length of the revolving period. Table 3 presents the age at which the representative patron would prefer a shift from 45 percent to 20 percent cash patronage refunds given selected parameter values.⁵ As the discount rate is increased, patronage refunds received late in the patron's farming career become less important to the present value calculation, and the patron would prefer to wait longer for the shift to occur. Increasing the rate of return to equity or decreasing the rate of growth from the baseline values at first lowers the age at which the patron would prefer a shift in the level of cash patronage refunds. Both changes shorten the length of the revolving period. Therefore, the patron would receive the cash from equity revolvment under the 20 percent plan earlier (see figures 1 and 2), resulting in a reduction in the age at which the patron would prefer the cooperative change plans. However, as

TABLE 2. Comparison of Representative Patron's Cash Flows, 20% and 45% Cash Patronage Refunds^a

Practice and period	Length of period	Cash patronage refunds	Patronage refund allocations	Patron equity retired	Patron income tax	Patron after-tax cash flow	Present value of after-tax cash flow	Revolving period
	(Yrs.)	----- (\$) -----						(Yrs.)
20% cash patronage refunds:								
Investment period	14	477.68	1,910.71	0.00	668.75	(191.07)	(100.71)	14
Active period	44	2,210.71	8,842.86	8,520.94	3,095.00	7,636.66	358.62	14
Disinvestment period	14	0.00	0.00	2,232.63	0.00	2,232.63	5.47	14
Total	72	2,688.39	10,753.57	10,753.57	3,763.75	9,678.21	263.38	14
45% cash patronage refunds:								
Investment period	34	3,556.12	4,346.36	0.00	2,212.69	1,343.42	325.77	34
Active period	24	2,492.77	3,046.71	2,753.54	1,551.05	3,695.25	53.88	34
Disinvestment period	34	0.00	0.00	4,639.54	0.00	4,639.54	6.41	34
Total	92	6,048.88	7,393.08	7,393.08	3,763.75	9,678.21	386.06	34

^a Given baseline parameter values, including patron marginal tax rate=.28 and patron discount rate=.10.

TABLE 3. Age at Which Representative Patron Would Prefer a Shift from 45% to 20% Cash Patronage Refunds

	Age	Present value of after-tax cash flow	Revolving period	
			Before shift	After shift
	(Yrs.)	(\$)	(Yrs.)	
Discount rate:				
.05	41	1,527.4	34	14
.10 ^a	43	476.0	34	14
.15	43	242.3	34	14
.20	44	161.8	34	14
.25	45	123.6	34	14
Rate of return:				
.15 ^a	43	476.0	34	14
.20	38	614.0	16	9
.25	35	745.4	11	7
.30	37	822.2	9	6
.35	72	911.8	7	5
Rate of growth:				
.025	76	608.7	15	10
.050	40	540.5	20	12
.075 ^a	43	476.0	34	14
Rate of return/ growth: ^b				
.15/.075 ^a	43	476.0	34	14
.20/.10	37	563.0	26	11
.25/.125	35	637.2	21	9

^a Baseline values.^b Proportionate increases in rates of return and growth.

further changes in the rate of return or growth are made, the difference in the length of the revolving periods for the two plans decreases. Consequently, equity revolvment becomes less important relative to cash patronage refunds, and the age at which the patron would prefer changing plans increases.

Collective Choice Analysis

Although the analysis in the previous section is useful for demonstrating how the preferences of an individual patron may change during the patron's lifetime, patrons generally cannot individually make decisions regarding patronage refunds and operation of the revolving fund. Instead, patrons as a group collectively make these decisions, usually through their boards of directors.

To analyze a cooperative's decisions regarding cash patronage refunds and equity revolvment, we adopt a collective choice model similar to those used by Zusman (1982, 1983) in his analyses of a marketing cooperative and an agricultural credit association and by Knoeber and Baumer (1983) in their analysis of retained patronage refunds. In our model, we assume that decisions about patronage refunds and the revolving period represent the interests of the median patron. Depending on specific state incorporation statutes, cooperatives may assign votes to members on a one-member/one-vote or personal basis, in proportion to patronage, or in proportion to equity holdings (Baarda 1986). Here we

determine the median voter on a one-member/one-vote basis because it is the method used by a substantial majority of cooperatives.⁶ However, in subsequent analysis, we will examine the effect of alternative voting schemes.

For the collective choice analysis, we calculated the future cash flow the median voter (a 49-year-old active patron) would receive from the cooperative for each level of cash patronage refunds from 20 percent to 45 percent. Because the amount of equity investment a patron holds in the cooperative and the performance of the revolving fund both depend on the level of cash patronage refunds the cooperative has paid in the past, earlier decisions by the cooperative can influence the median voter's choices. To account for this, we employed two alternative assumptions about the initial state of the revolving fund. Under the first, we assumed that up to now the cooperative has been paying 20 percent of its patronage refunds in cash. Under the second, we assumed that the cooperative has been paying 45 percent cash patronage refunds.⁷ To examine how a voter's age might affect the cooperative's choices, we also calculated the cash flows that would be received by the lower and upper quartile voters (active patrons respectively 39 and 59 years old).

We also explored how sensitive the results were to changes in the patron discount rate and to modifications of the estimated sales function on which the flow of patronage refunds is based.⁸ In scenario B, the baseline scenario, we used the estimated sales function to generate the flow of patronage refunds received during the median voter's farming career. In scenarios A and C, we investigated the effects of asymmetric patronage refund functions in which most of the patronage occurs either early or late in the patron's farming career. These functions were constructed by compounding the annual data from the estimated sales function used in scenario B by 3 percent and -3 percent respectively and by normalizing the results so total patronage refunds were the same as in scenario B. Under scenarios A and C, respectively 65 percent and 29 percent of total patronage refunds are received before the median age, compared with 49 percent under scenario B.

The results of the collective choice analysis are presented in table 4. Given the baseline parameter values, the median voter would maximize the present value

TABLE 4. Percentage Cash Patronage Refunds, Median and Quartile Patron Preferences

	45% initial state			20% initial state		
	Lower quartile	Median	Upper quartile	Lower quartile	Median	Upper quartile
(%)						
Discount rate:						
.05	21	20	20	20	20	20
.10 ^a	21	20	20	20	20	20
.15	21	20	20	20	20	20
.20	21	20	20	20	20	20
.25	21	20	20	20	20	20
Scenario:						
A	21	20	20	20	20	20
B ^a	21	20	20	20	20	20
C	21	21	20	20	20	20

^a Baseline values.

of future after-tax cash flow by choosing that the cooperative follow a practice of paying 20 percent cash patronage refunds, whether or not it previously had been paying 20 percent or 45 percent cash patronage refunds. Regardless of what level of cash patronage refunds the median voter had been receiving, by age 49 the patron's equity investment in the cooperative would be sufficiently large to encourage the patron to choose the most rapid revolvment of equity possible instead of a high level of cash patronage refunds during the remaining years of the patron's farming career. Older patrons, represented by the upper quartile voter, would share this preference. Only the lower quartile voter who previously had received 45 percent cash patronage refunds would prefer to receive a higher proportion of patronage refunds in cash, and that voter's preference would only be for 21 percent cash patronage refunds.⁹

These results are insensitive to changes over a broad range of discount rates. In addition, results identical to these were obtained under scenario A. The results from scenario C are different only in that the median voter prefers 21 percent cash patronage refunds given an initial state of 45 percent cash patronage refunds, and this preference converges to 20 percent cash patronage refunds in one more year.

In total, these results suggest that, under the median voter rule, we would expect a typical farmer cooperative to select a practice of paying 20 percent of its patronage refunds in cash. Moreover, this result appears to be fairly insensitive to changes in the median voter's age, the patron discount rate, and the distribution of patronage refunds over the patron's farming career.

Comparison with Observed Practices

To evaluate the predictions of the collective choice model, we can compare them to the proportion of patronage refunds paid in cash by centralized cooperatives, i.e., cooperatives that are owned by individual farmer patrons in contrast to federated and mixed cooperatives, which respectively are owned by other cooperatives or a combination of other cooperatives and individual farmers. According to a recent study of the equity allocation and redemption practices of U.S. agricultural cooperatives by Rathbone and Wissman (1993), 35 percent of centralized cooperatives, comprising the largest category, paid from 20 percent to 24 percent of their patronage refunds in cash. This figure is consistent with the results predicted by the median voter decision rule. However, as table 5 shows, the results of the collective choice analysis do not explain the practices of a sizeable proportion of the cooperatives included in the Rathbone and Wissman study.¹⁰

TABLE 5. Cash Patronage Refunds Paid by Centralized Cooperatives, 1991

Cash Proportion	Cooperatives (%)
Less than 20%	1
20-24%	35
25-29%	6
30-34%	21
35-49%	13
50-74%	11
75% and over	13

Source: Rathbone and Wissman 1993.

One explanation for the difference between the model's predictions and some of the observed data may be an extreme reluctance of cooperatives to expose patrons to negative cash flows due to taxes by paying a cash proportion less than the combined rate of federal income tax, state income tax, and federal self-employment tax, which can exceed 50 percent. Regardless of the benefits a lower proportion of cash patronage refunds may provide the median voter, directors and managers may believe that paying lower cash patronage refunds would have undesirable consequences for the cooperative in terms of its ability to attract and retain the business of younger farmers.

Another factor that might help explain the observed data is that patrons may use fairly high discount rates in evaluating future cash flows from cooperatives. As the discount rate is increased, the differences between the payoffs from the choices to be made by the median voter become smaller. For example, as the discount rate is increased from 10 percent to 25 percent, the difference between the largest and smallest payoffs declines from almost 25 percent to less than 1 percent. Thus, at fairly high discount rates, there is a high degree of indifference among the plans according to the present value criterion, and choices can be easily justified according to another criterion, such as avoidance of negative cash flows.

Finally, a third, related explanation is that cooperative patrons may use two discount rates for evaluating future cash flows from a cooperative. A patron might use one rate for discounting cash patronage refunds and another, higher rate for discounting noncash patronage refunds because of the additional risk associated with the performance of the cooperative's revolving fund over time, given changes in managers, the board of directors, and the organization's financial status. Although the preferences of the median voter in the baseline scenario are insensitive to changes in a single discount rate applied to both cash and noncash patronage refunds, preferences between 20 percent and 45 percent cash patronage refund plans are reversed if a 4 percent risk premium is added to a 10 percent basic discount rate when discounting noncash patronage refunds.¹¹

Former Patrons and Alternative Voting Schemes

We now turn our attention to the role of former patrons in making decisions about patronage refunds and equity revolvment. Although no recent data exist, Brown and Volkin (1977) found that 69 percent of centralized cooperatives held equity allocated to inactive patrons in 1974. In fact, 56 percent of all equity holders were inactive, and they held 22 percent of total allocated equity. Inactive equity holders are often disenfranchised from participating in decisions on patronage refunds and equity revolvment by bylaw provisions that permit a cooperative to terminate the membership and voting rights of members who have ceased patronizing the organization. Cooperatives may adopt these provisions in order to comply with statutory requirements designed to limit membership to agricultural producers.¹² However, despite these pressures, Frederick (1989) reports that during the 1980s about a fifth of the memberships in farmer cooperatives were held by inactive patrons.

Table 6 presents the age of the median voter under several alternative voting schemes and scenarios, depending on whether former patrons are included in the assignment of votes. In evaluating the effect of allowing inactive patrons to vote, we alternately use Frederick's figure for inactive members and Brown and Volkin's figure for inactive equity holders for the proportion of members who are former

patrons. Because individual equity investments in the cooperative are dependent on the proportion of patronage refunds that have been paid in cash, the effects are examined for both 20 percent and 45 percent cash patronage refunds.

TABLE 6. Age of Median Voter Under Alternative Voting Schemes

	Age (Yrs.)	
	Former patrons excluded	Former patrons included
One-member/one-vote:		
20% former patrons	49	54
56% former patrons	49	79 ^a
Proportional voting based on patronage	50	^b
Proportional voting based on equity holdings:		
20% cash patronage refunds	55	58
45% cash patronage refunds	61	68

^a Age 79 is used here in a general sense to represent some post-retirement age.

^b Not applicable.

As table 6 shows, assignment of voting rights to former patrons generally would be expected to increase the age of the median voter. However, the inclusion of former patrons would not be expected to have an impact on the cooperative's choice of patronage refund and equity revolvment practices if the preferences of active patrons are determined strictly by the present value criterion because the median voter in that model already would be expected to select a practice of low cash patronage refunds and rapid equity revolvment. On the other hand, if the preferences of active patrons are not determined by the present value criterion, an increase in the age of the median voter might be expected to result in decisions more favorable to former patrons. In the case of the one-member/one-vote method, assignment of voting rights to inactive equity holders would raise the age of the median voter to a post-retirement level, likely ensuring former patrons selection of a practice of rapid equity revolvment.

If cooperatives are prohibited from assigning voting rights to former patrons, the adoption of proportional voting schemes has potential for raising the age of the median voter and thereby benefiting former patrons. However, given the sales function and patron age distribution estimated in this study, a proportional voting system based on patronage would have only a minimal impact on the age of the median voter. This impact would be greater under proportional voting systems based on equity holdings, particularly if the cooperative has had a practice of paying a high proportion of patronage refunds in cash.

Conclusions

This study demonstrates that patron preferences regarding the proportion of patronage refunds a cooperative pays in cash change during the course of the patron's farming career and are affected by various personal and cooperative characteristics.

Collective choice analysis based on the median voter rule, an estimated sales function, and an estimated patron age distribution suggests that cooperatives will pay the 20 percent minimum cash patronage refunds required for deduction of patronage refunds from taxable income. Although this conclusion is consistent with the practice of a substantial proportion of cooperatives, it does not explain why many cooperatives choose to pay more than 20 percent of patronage refunds in cash. Explanations for why they do may be based on an aversion to subjecting younger members to negative cash flows due to taxes, an indifference among different levels of cash patronage refunds at high discount rates, and a distinction among patrons between the rates used to discount future cash and noncash patronage refunds.

An analysis that considers the interests of former patrons and alternative voting schemes indicates that cash patronage refund practices may be marginally affected by assigning voting rights to former patrons. In addition, these practices may be influenced by alternative voting schemes, especially proportional voting based on equity holdings.

Notes

1. According to Rathbone and Wissman (1993), 92 percent of the centralized cooperatives that had systematic equity plans in 1991 used the revolving fund plan. However, only 48 percent of the cooperatives had systematic plans, and most of those were operated in conjunction with a special plan, in which equity was redeemed according to special circumstances, such as death or retirement. The remaining 52 percent of the cooperatives had no active equity redemption plan or only operated a special plan.

2. In the sales function estimated by Barton and Schmidt, sales per age category, instead of sales per farmer, is expressed as a quadratic function of age. Although the Barton and Schmidt model produces a better fit ($R^2=.7960$), we consider sales per farmer to be the appropriate dependent variable. Regardless, the Barton and Schmidt function is shaped similarly to ours and would produce essentially the same results.

3. It is assumed that patronage refunds are distributed in "qualified" form, i.e., that the cooperative pays at least 20 percent of the refunds in cash and is able to deduct the refunds from its taxable income by obtaining the consent of its patrons to include the refunds in their incomes. For the differences between "qualified" and "nonqualified" patronage refund allocations, see Royer 1989. For a comparison of patron after-tax cash flows, see Royer 1987.

4. One reviewer expressed interest in the alternative of paying a very high percentage of patronage refunds in cash and financing the cooperative with unallocated retained earnings. For a comparative analysis of this method, see Royer 1982.

5. The cash flow calculations reported in table 3 and used to determine the age at which the representative patron would prefer a shift from 45 percent to 20 percent cash patronage refunds take into consideration the period of adjustment, approximately equal in length to the new equilibrium cycle, during which the revolving period converges toward the new equilibrium. The revolving periods presented in table 3 represent equilibrium values.

6. According to Ward, Schneider, and Lopez (1979), 92.6 percent of cooperatives used the one-member/one-vote method in 1976, 3.6 percent used proportional voting based on patronage, and 2.6 percent used proportional voting based on equity capital. The remaining 1.1 percent used other methods, frequently a combination of the three principle methods.

7. We limited our analysis to assuming initial states of 20 percent and 45 percent cash patronage refunds because of the combinatorial problems associated with simulating every level of cash patronage refunds between 20 percent and 45 percent for every initial state between 20 percent and 45 percent. Experiments with selected initial states between 20 percent and 45 percent and the robustness of our results appeared to validate this approach.

8. We did not consider the sensitivity of the results to changes in the rate of return to revolving equity or the rate of growth in equity. We reasoned that cooperatives would not set the rate of growth independently of the rate of return, and setting growth at a rate substantially different from that observed for the period from which the sales function was estimated would produce inconsistencies between the two.

9. Furthermore, the lower quartile preference converges to 20 percent cash patronage refunds given an additional year. In that following year, the *new* lower quartile patron, who will have received 45 percent cash patronage refunds for 17 years and 21 percent cash patronage refunds for 1 year, would prefer receiving 20 percent cash patronage refunds during the rest of the patron's farming career.

10. According to U.S. Department of Agriculture financial profile studies, an average 50 percent of the patronage refunds allocated by farmer cooperatives in 1970, 1976, and 1987 were paid in cash (Griffin et al. 1980; Royer, Wissman, and Kraenzle 1990). This average includes federated and mixed cooperatives, whose behavior cannot be explained by a collective choice model based on the preferences of individual farmer patrons. Federated cooperatives, which heavily weight the average, often maintain long-term stable relationships with member cooperatives. Consequently, these cooperatives may pay a high level of cash patronage refunds because equity redemption is not as important as a means of adjusting member financing to use of the cooperative.

11. Another explanation, suggested by a reviewer, that accounts for some of the difference between the model's predictions and the data in table 5 is that the cooperatives represented by the table include marketing cooperatives financed by per-unit capital retains. These cooperatives frequently have marketing agreements with their members and may pay members conservative cash prices for the products they market, followed by high cash patronage refunds. The reviewer suggested that an appropriate comparison group would be local grain and farm supply cooperatives because they tend to pay and charge competitive prices and rely on retained patronage refunds for financing. According to U.S. Department of Agriculture data (Royer, Wissman, and Kraenzle 1990), these cooperatives averaged paying 33 percent cash patronage refunds in 1987. The same reviewer also suggested that use of the base capital plan or another systematic equity redemption plan might result in a preference for higher cash patronage refunds.

12. Statutory incentives for terminating former patrons include antitrust protection offered marketing cooperatives by the Capper-Volstead Act, deductions from federal taxable income allowed farmer cooperatives qualifying under section 521 of the Internal Revenue Code, and state incorporation statutes that require members to be engaged in the production of agricultural products.

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