Modeling Member Responses to the Farmer Owned Cooperative's Alternative Capital Management Strategies

By

Francisco Diaz-Hermelo
Ph.D. Student, Purdue University

Allan Gray
Assistant Professor, Purdue University

Edward Smith
Distinguished Roy B. Davis Professor of Agricultural Cooperation, Texas A&M University

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Abstract

Research directed toward determining the optimal capital structure for agricultural cooperatives could provide solutions to debt-related financial stress problems (Moller, Featherstone, and Barton, 1996). Assessing the cooperatives' member needs, proper capitalization, and economies of scale are among the critical areas that need attention (Torgerson, 1992).

This research dynamically models the capitalization of agricultural cooperatives with the ultimate goal of providing information that helps reduce the cooperatives financial stress and adequately addresses the member-owner's needs. Specifically, this research explores alternative equity management strategies for farmer-owned cooperatives. Unlike other equity management studies, this research focuses on the transition from current equity management practices to equity management practices that improve the cooperative's control over capitalization of assets, maintain competitiveness, and maximize the return to the individual farmer-owners in a risky economic and financial environment.

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Introduction

Rapid change in the agricultural industry creates opportunities for agricultural cooperatives. For example, the rapid consolidation among farm input and output companies reduces producers' bargaining power, which strengthens the unique role for the farmer-owned cooperative as a counter-veiling power to a consolidating agribusiness industry. Also, rapid technology improvements are changing the farming environment and creating new opportunities for cooperatives in providing farmers with access to these technologies. Specialty crops and development of new consumer markets also create new opportunities but require investments in special processing equipment and distribution channels.

To take advantage of these opportunities the farmer-owned cooperative must have access to adequate capital resources and the financial flexibility to choose from the different capital sources that better serve the pursue of new opportunities. Financial flexibility results from the cooperative maintaining control of its financial capital structure. At the same time the cooperative must satisfy its members, who joined the cooperative primary for economic reasons (Cobia, 1989). In many instances, cooperatives use higher cash patronage refunds or favorable prices to entice producers to do business with the cooperative. Higher cash patronage and lower margins may reduce equity sources that provide for stability and growth. In other cases, cooperatives may retain large allocated earnings positions to invest aggressively in new business opportunities. The tradeoff, however, is low cash patronage refunds, which may hurt the relationship with members and effectively reduce demand for the cooperatives products and services. If the cooperative places too much emphasis on current cash patronage refunds it constrains its ability grow. However, if current cash patronage refunds are not maintained at a certain level the cooperative can lose business because producers may not perceive immediate benefits from patronizing the cooperative.

Cooperatives seeking to grow, acquire new technologies, offer new services, or pursue strategic alliances or joint ventures need access to capital. How does a cooperative maintain it's competitive position, control the balance sheet and return on investment for future growth while maintaining ownership in line with use? A better understanding of cooperative capital structure and flexibility that better serves members interests appear to be particularly relevant research topic.

Agricultural economists have identified these topics as a high priority in the cooperative research area. Torgerson (1992) noted that assessing the cooperatives' member needs, proper capitalization, and ensure growth to achieve economies of scale are among the critical areas that need research attention. As recently as 1996, Moller, Featherstone and Barton wrote that research directed toward determining the optimal capital structure for agricultural cooperatives could provide solutions to debt-related financial stress problems (Moller, Featherstone, and Barton, 1996). Cobia (1989) points out most poignantly that a serious flaw in the performance of cooperatives is their failure to redeem equity of over-invested members and to secure more funds from those not providing equity according to their share. While this transition is difficult, Royer (1989) outlines two important objectives of a good equity management strategy. First, the strategy must provide an adequate supply of equity capital for financing working capital and fixed assets. Second, provide an equitable procedure for acquiring and redeeming current equity investments. In many cases, the overall financing plans of cooperatives aren't equitable because they don't include a systematic and regular plan for redeeming patron equities (Royer, 1989).

Previous studies have done significant contributions analyzing the impact of different capital management strategies on the cooperative and its members. However, they did not capture the complexity of the unique dynamic nature of the interaction between cooperatives and their patron-members. The importance of the dynamics of the cooperative and patron-members relationship was well stated by Schmiesing in Cobia 1989,

> "The cooperative initiates a pricing and patronage refund policy to achieve a specific cooperative objective and the patrons respond to the implementation of the firm's strategy. Whether a specific cooperative's objective will actually be achieved depends on the response of patrons."

The dynamic interactions between the cooperative's profitability, growth, profit allocation and its user-owners, is an important issue to considers and deserves to be addressed for research.

Another issue that has been addressed in some previous studies but deserves further research is the risk implications of the different capital management strategies for the cooperative and member/owners. Most of the previous research has been deterministic simulation and deterministic optimization. Only a few of the studies have performed some kind of risk analysis For, example, Barton, Parcell and Featherstone (1996), and Knoeber and Baumer (1983) studied the capital structure of cooperatives under risk. However, the implications of different equity management strategies have not been studied and also capital management under uncertainty has never been studied accounting also for the dynamic response of members. Without risk in the studies the outcomes for alternative strategies will not be robust enough for actual decision-making in a risk economic environment (Richardson, 2000).

The overall goal of this research is to identify alternative capitalization strategies that enhance the farmer-owned agricultural cooperative's control of their capital structure, growth and return on investment, while maintaining the user-owner balance in a way that provides an acceptable level of financial risk. Specifically, this research develops a stochastic, dynamic financial simulation model of the capital management behavior of farmer-owned cooperatives. The objective of the research is to analyze the risk return trade offs of alternative asset capitalization strategies for farmer owned cooperatives and provide cooperative management with information to improve their capital management strategies in a way that is consistent with the cooperative's goals and members need.

The specific objectives of this research project are to:

- Evaluate the risk/return of alternative capital management strategies in terms of the cooperative's control over capitalization of assets, competitiveness, and the returns to the individual farmer-owners in an uncertain economic and financial environment.

- Explicitly recognize the relationship between cash patronage, the value of cooperative equity, and the impact on future product and service demand.
- Use a case study cooperatives to illustrate the effects of alternative capital management strategies given the structure and needs of the members for the individual cooperative.

The next section of the paper describes the methodology used to link the financial activity of the cooperative to demand for future products and services by members. The third section describes preliminary results from application of the model to the case of a cotton ginning West Texas cooperative. The results first focus on comparing the results from including members' response versus without including them. The final section will focus on the financial and economic impacts of different alternative capital management strategies for the cooperatives.

Method of Analysis

In the past, simulation has been a useful tool to study cooperatives' operations' investment, capitalization and equity management decisions. Previous research using simulation to study cooperatives' financial and strategic decisions includes Beierlein, (1977), Beierlein and Schroeder, (1978), Gray (1998), Poray and Ginder (1999), Laughlin (1999), and Barton et al (1995).The model proposed here builds on FRAN (Financial Risk Analyzer), a firm level stochastic model developed at Texas A&M University (Gray, 1998). A members' simulation component is added to the stochastic simulation STRES, an adaptation of FRAN, to provide a dynamic feedback mechanism between the cooperative and its members. The dynamic simulation model accounts for the interactions between the cooperative's profitability, growth, and user-owner allocation, the cooperative and its competitors, and the member-owners cash flow burdens. By explicitly capturing the dynamic cash flow relationships between current cash patronage, equity redemption, and capital replacement, the model estimates the impacts and tradeoffs of alternative management strategies on the firm's cash flows, ability to grow, and user/owner balance. The model also captures the dynamic relationships between the firm

and its market environment including interactions with competitors, customer retention, and market share growth.

STRES can handle a large number of sales, business and financial variables. The model provides several detailed pro-forma financial statements and statistics over a predetermined planning horizon. The model was designed to provide results in a regular business-accounting form so the results can be used to easily interact with management and the board of directors.

Stochastic variables in STRES are defined using ten years of historical data. The historical data for each random variable is used to define an empirical probability density function (PDF) around the mean projections in the model. For each iteration that STRES is run stochastically, the empirical distributions on stochastic variables are sampled and the random values are used to calculate financial outcomes. By using historical data to define the distributions for the inputs, STRES captures the historical risk associated with the random variables. Stochastically simulated outcomes for alternative management strategies available to the business can be evaluated assuming past variability is a reasonable forecast of future risk. The random variables are correlated intra-temporally based on historical correlation coefficients to further insure that post risk is incorporated.

The member behavior addition to the model reflects how changes in income affect patronage, which affects willingness to do business with the cooperative, and which in turn influences future volume and future income. The most important difference between a model that does not consider members' responses and a model that does is in the growth rate in volume. In the case where the model contains no member response, the growth rate is exogenous to the model. In the case where the model incorporates member responses, the growth rate is equal to the exogenously projected growth rate adjusted endogenously for member patronage behavior. Members' responses are a function of cash patronage refunds, equity credit refunds, the valuation of equity credit refunds, expectations of future cash and equity credits refunds, transaction price, own price elasticity, cross price elasticity and competitor's price response. Figure 1 shows a simplified diagram of the model and the interactions that have been added to the STRES model.

The derivation of the members' response model starts with the typical demand function where changes in volume demanded depend on changes in the net own price (transaction price less cooperative returns), the own price elasticity, changes in competitors price (as a function of changes in own price) and the cross price elasticity. Equation 1 summarizes the relationship.

$$\%\Delta Q = \varepsilon \%\Delta E[Pnet] + \delta \%\Delta P_{IOF} \qquad (1)$$

Where:

$\%\Delta Q$	percentage change in volume demanded from year t-1 to year t
$\%\Delta$P net	percentage change in the net price members pay for the cooperative's goods and services from year t-1 to year t
$\%\Delta P_{IOF}$	percentage change in the net price members pay to investor owned firms for goods and services from year t-1 to year t
ε	members' own price demand elasticity
δ	members' cross price elasticity
E[…]	members' expectation operator for determining net price

The net price charged to cooperative members is the transaction price at the time of the exchange of goods and services minus the expected value of the cash and allocated equity at the end of the fiscal year. Since patronage refunds are paid at the end of the year, members must estimate the net price charged to them by forming an expectation of future patronage (Cobia, 1989). Equation 2 illustrates the member's formation of a net price (P_{net}). The expected price consists of the price charged at the time of the transaction (P_{rans}), and expected cash patronage refund (CPR) and the value of equity credits (ECV), both of which are discounted by one period to reflect the delay until the end of the cooperative's fiscal year when profits are distributed to members.

$$E[Pnet_t] = Ptrans_t - \frac{1}{(1+r_m)} E[CPR_t] - \frac{1}{(1+r_m)} E[ECV_t] - \frac{1}{(1+r_m)} E[Div] \qquad (2)$$

Where:

P net $_t$	the net price paid by the member in year t
P trans $_t$	the transaction price at the time of the deal between the cooperative and the member
E […]	the expectation operator
CPR $_t$	cash patronage refund paid to the member at the end of the fiscal year t
ECV $_t$	the value of the patronage refund paid in equity credits to the member at the end of the fiscal year t
Div	the dividends paid on investment to the member at the end of the fiscal year t
r $_m$	member's discount rate

Substituting equation 2, equation (1) becomes

$$\%\Delta Q_t = \varepsilon\left(\frac{\Delta Ptrans_t - \frac{\Delta E[CPR_t]}{(1+r_m)} - \frac{\Delta E[ECV_t]}{(1+r_m)} - \frac{\Delta E[Div]}{(1+r_m)}}{Pnet_{t-1}}\right) + \delta\%\Delta P_{IOF,t} \qquad (3)$$

The expectation operator is a weighted average of past cash and equity credits patronage refunds. Equations 4 and 5 illustrate the expectations formulations for cash patronage and the value of equity credits. Each variable's expectation is formed by a weighted average of up to the previous 10 years cash patronage and allocated equity.

$$E[CPR_t] = \sum_{i=1}^{10} w_{t-i} CPR_{t-i} \qquad (4)$$

$$E[ECV_t] = \sum_{i=1}^{10} w_{t-i} ECV_{t-i} \qquad (5)$$

The next problem in developing a members' response model is determining the value members assign to allocated equity credits. Economic theory and corporate finance theory bring some useful concepts and ideas. An allocated equity credit from a cooperative is a financial asset similar to a corporate stock. The fundamental theory of economic value says that the value of an economic good is the net present value of future returns from that good. Following the same principle, finance theory says the value of

stocks is the net present value of future cash flows to the owners of the stock. The value of a stock is the expected dividends to be paid in perpetuity discounted to the present. Considering that those dividends could grow over time, the corporate stock valuation equation becomes,

$$VS_0 = \frac{DPS_1}{(\text{Re} - g)} = \frac{EPS_1(1-RR)}{(\text{Re} - g)} = \frac{BVS \times ROE(1-RR)}{(\text{Re} - g)} \qquad (6)$$

Where:

VS_0	the value of the stock at time t=0
DPS_1	expected dividends per share at t=1
Re	stockholder discount rate
g	expected dividends growth rate
EPS_1	expected earnings per share at t=1
RR	retention ratio (retained earnings per share / earnings per share)
BVS	book value of stock
ROE	return on equity

Dividend per share is earnings per share minus the retained earnings per share that are retained for future investments. Earnings per share depend on the book value of the equity and the ROE of the firm. The more efficiently managers use the assets of the firm and control the capital structure of the firm, the higher the ROE and therefore the higher the earnings per share and the dividends per share that stockholders will receive.

Assuming that the corporation is not being poorly managed, the only source of growth in dividends is the additional investments made by the corporation with retained earnings and the ROE of those investments. This is the reason why many firm stock values increase when their dividends are low or non-existent. The stockholders have a high expectation of returns on the additional investments and their return on investment. As a consequence the expected dividend growth is high, increasing the value of the stock in Equation 6.[1]

[1] For a more detailed discussion of stock valuation the reader can consult any of the following books, Ross, Westerfield and Jaffe, "Corporate Finance," Sixth Edition, McGraw-Hill 1998; Palepu, Healy and Bernard, "Business Analysis and Valuation," Second Edition, South-Western 2000; or one of the classics, Williams, John Burr, "The Theory of Investment Value," Fraser Publishing, 1997.

The same valuation principles could be used to determine the value of cooperative equity credits. The value of equity credits is the net present value of cash flows that members will receive from equity credits. One difference between cooperative equity and corporate equity is that a profitable cooperative is expected to redeem the equity back to members. Thus, one of the benefits members gain from owning equity credits is the book value of the equity credit at the time the cooperative decides to redeem equity. Traditionally, analysis has considered this to be the only value associated with equity credit refunds. However, this is not the total cash flow that members will receive from the equity credits. The cooperative issues equity credits to members to retain earnings for investment. As long as the management team invests in profitable projects and manages them successfully those investments will generate additional earnings to the cooperative. For example, a grain-marketing cooperative that decides to invest in infrastructure to handle specialty crops may be able to pay additional cash patronage, dividends, and/or allocated equity credits to members from the incremental earnings coming from the new business. Therefore, it is necessary to include the incremental cash flows associated with retained member patronage when placing value on equity credits.

The value of equity credits is a function of the expected incremental value of cash patronage and dividends plus the discounted book value of equity. Equation 7 summarizes this relationship for an individual member.

$$ECV_{m,t=0} = \sum_{t=1}^{E[T]} \frac{E\left[ICPR_{m,t}\right]}{(1+r_m)^t} + \sum_{t=1}^{E[T]} \frac{E\left[Idiv_{m,t}\right]}{(1+r_m)^t} + \frac{CBV_{m,t}}{(1+r_m)^{E[T]}} \qquad (7)$$

Where:

$ICPR_{m,t}$	incremental cash patronage paid to member m at the end of fiscal year t
$Idiv_{m,t}$	incremental dividends paid to member m at the end of fiscal year t
CBV	the book value of equity credits paid to member i
E [T]	the expected time horizon for equity redemption
r_m	member m discount rate

The expectation of T is formed based on the weighted average age of equity over the previous ten years as follows:

$$E[T_t] = \sum_{i=1}^{10} w_{t-i} T_{t-i} \qquad (8)$$

The total cash patronage paid to members is a portion of total profits. The portion of total profits that the management team pays to patrons is called the cash patronage payout ratio. The total amount of cash patronage is distributed among patrons according to their share of total business done with the cooperative in the applicable year. Therefore, the cash patronage received by a single member is a function of net profit, the cash patronage payout ratio and the member's share of total patronage. Net profit is a function of total equity and how efficiently managers use that equity, usually measured by the return on equity. By multiplying the book value of equity credits by the cooperative's ROE, the expected incremental net profit produced by that equity credit could be obtained. Multiplying the incremental net profit by the cash patronage payout ratio and the individual members share of total future business done, yields the individual members expected incremental cash patronage refunds in future years generated from this year's allocated equity credits. Thus, the expected incremental cash patronage refund at any time for any member is:

$$E[CPR_{m,t}] = E[ROE_t] ECBV_m cr_t s_{m,t} \qquad (9)$$

Where:

$E[ROE_t]$	is the cooperative's expected return on equity at year t
cr_t	is the cash patronage payout ratio at year t
$s_{m,t}$	is the share of business of member m in year t

Following the same reasoning, the expected dividends to be received, if the cooperative pays a dividend to their members, is

$$E[Div_{m,t}] = E[ROE_t]ECBVdr_t w_{m,t} \qquad (10)$$

Where:

dr_t is the dividend payout ratio at year t
$w_{m,t}$ is the equity share of member i at year t

Substituting Equations (9) and (10) into Equation (7) the value of equity credits becomes

$$ECV_{m,t=0} = \sum_{t=1}^{E[T]} \frac{E[ROE_t]ECBV_m cr_t s_{m,t}}{(1+r_m)^t} + \sum_{t=1}^{E[T]} \frac{E[ROE_t]ECBV_m dr_t w_{m,t}}{(1+r_m)^t} + \frac{ECBV_m}{(1+r_m)^{E[T]}} \qquad (11)$$

The value that members put on the equity credits may be more or less than the book value of the equity credits depending on the length of time before the equity is redeemed and the amount of expected incremental cash flows associated with the equity while it is being used by the cooperative. The value of incremental cash flows will depend on the expected ROE, the cash patronage and dividend payout ratios, the expected time horizon before equity is redeemed and the individual member's share of total business and total equity. For example, a year with a high net profit and high patronage refunds will increase member's expectations of future cash flows, positively impacting the value of equity credits. A bad year with a poor patronage refund will have a negative impact on member expectations resulting in a negative impact on the value of equity credits.

The return on equity also affects the value of equity credits. The return on equity is the best financial indicator of how well the cooperative is using members' equity. At the time the cooperative decides to retain profits to build equity for future investments, the success of those investments will determine how well the cooperative will serve members in the future and how much profit and patronage refunds the cooperative will return to members. Observations as to how successful the cooperative has been in the

past, are likely a necessary predictor of how well the cooperative will perform in the future. Members should welcome additional investments in a successful, competitively priced, cooperative with a large ROE because they will expect the cooperative to be successful and return large patronage refunds in cash and allocated equity credits in the future. As a consequence, members will have more confidence in the cooperative investments and will place more value in the equity credits issued by the cooperative.

Increases in equity redemptions will also have a positive impact on the value of equity credits and therefore a positive impact on growth. In Equation 11, equity redemptions affect the members' expectations of the time their money will be retained in the cooperative. Lower equity redemptions increase the time the members' money remains invested in the cooperative, which reduced the current value of these future redemptions. To the extent that the equity credits are creating positive cash flows, the negative effect of the lower equity redemptions can be offset.

The members demand equitation derived from Equations 1 and 2 conclude that members' willingness to do business with the cooperative is a result of price, cash patronage, dividends and investments done by the cooperative with the patronage retained.

If the cooperative needs to increase the retention of profits to make new investments (such as, capacity expansions), cash refunds will decline and equity credits will increase. The decrease in cash patronage has a negative impact on the volume growth rate. The effect of the increase in equity credit patronage will depend on the valuation of equity credits. If the cooperative has historical high ROE and a stable equity redemption program, the valuation of equity credits will be high and will offset to some extent, the effect of lower cash patronage. This would be the case for a cooperative with a successful track record, enticing members to stay with the cooperative because they expect to benefit from future business with the cooperative. To the contrary, if the cooperative had a poor ROE and a bad history of equity redemption, the valuation will be low and there will be a net negative impact in volume growth.

STRES and the members' response addition complement each other in the following way. STRES simulates the cooperatives' operations for any given year t and produces a series of financial results. The members' addition takes the financial variables

described in the previous equations from STRES and simulates the members' response in year t+1 to the financial outcome of the cooperative. The volume demand resulting from the members' response simulation feeds back to the primary STRES component, which uses the demand value to generate a new set of financial outcomes for year t+1.

Description of The Case Study Cooperative

The stochastic simulation model (STRES) was calibrated and applied to a West Texas cotton ginning cooperative. The West Texas cooperative has a five-year average annual revenue of $3.7 million. Ginning services account for 85 percent of the income and the rest comes from associated services such as transportation of cottonseed, compression and sampling fees. The five-year average net profit is $850,000. The assets of the cooperative, according to year 2000 audited financial statements, were $3.6 million, and total equity was $2.5 million. All equity was allocated to members and only 2.5 percent was issued nonqualified. The cooperative is efficient in the use of its assets and equity with a five-year average net margin of 22 percent, average return on assets of 21 percent, and a five-year average return on equity of 41 percent.

The cooperative is expected to gin 40,000 bales in the first year of the simulation. Expected volume is assumed to increase at 2 percent per year based on technology expansion and market development, before any member responses are taken into account. The profit allocation policy followed by the cooperative is to return a minimum of 40 percent as cash to patrons. In the past, the cooperative has been able to pay an average of 50 percent of profits back to members in cash. Remaining earnings have been used to increase investment and to retire members' equity. The oldest equity is 11 years. All the retained earnings are allocated as qualified to reduce the tax burden to the cooperative. The board policy is to use debt to finance approximately 50 percent of fixed asset acquisitions. The cooperative does not use debt to retire old equity or to manage the capital structure (debt to equity relationship).

There are several parameters in the member response model that must be estimated. These variables include the own price, cross price elasticities, the response of competitors to changes in the cooperative transaction prices, and the weight factors for the different historical years. The ideal situation would be to collect historical data from

numerous farmer-owners and estimate those parameters through econometric techniques. However, this process is unduly burdensome because of the amount of data required. This methodology is beyond the scope of this research so parameter values were obtained by eliciting survey responses from the management team. The process consists of proposing several changes in own price to managers and directors and ask them to define what changes they expect on volume of business done with the cooperative. Then they were asked to predict how competitors would react to those changes in terms of their own pricing. The same procedure was followed to find the cross price elasticity. Several changes in competitor prices leaving own price constant were proposed and managers and directors were asked to define what changes they would expect on their cooperative's volume of business. Finally, they were asked for all the financial parameters required in the members' model including the weight they would assign previous years for estimating next year's values.

Based on responses to the survey, a weighted average estimate of own price elasticity, cross price elasticity, and the historical weighting for expectations formation were calculated. According to the management team, the own price elasticity is –0.5, and the cross price elasticity is –0.5. In addition, the management team indicated that competitors would immediately replicate any changes in transaction price made by the cooperative, and that members form their expectations of future cooperative performance 80 percent on the immediate preceding years performance and 20 percent on 2 years prior.

The historical information and parameters described above were used to calibrate the model and obtain the results to compare the current profit allocation and equity redemption strategy for the West Texas Cooperative with 4 alternative capital management strategies. The results are presented in two sections. The first section describes the year-to-year evolution of four critical financial variables and the risk exposure of the cooperative. The second section describes the net present value of total cash flows to the cooperative and its members and uses a stochastic dominance framework to analyze the risk return implications.

Alternative Capital Management Strategies

In the baseline, the cooperative returns 40 percent of current year profits in cash to members and then uses remaining cash to resolve equity, with the goal of bringing the age of equity to 5 years; the cooperative currently has eleven-year-old equity. If additional cash is remaining after reaching the five-year equity target, the remaining cash is used to increase the cash patronage percentage above the initial cash patronage level of 40 percent. Under the baseline, the cooperative does not use debt financing to achieve its desired equity age of 5 years (the model does, however, assume that debt financing is used to acquire new assets at 50 percent of the asset value, and debt financing is used to cover any cash flow deficits from business loss).

Alternative 1 focuses capital allocations on achieving the 5-year age of equity target. In particular, this alternative prioritizes capital by first paying the minimum 20 percent cash patronage as required under the qualified allocation rules, then assets are replaced using 50 percent cash 50 percent debt financing. All of the remaining cash is then used to redeem as much equity as possible to reach the 5-year age of equity target or a minimum equity of $50 per bale (based on a 5-year moving average of total bales ginned). If any cash is remaining after equity has been redeemed, the remaining cash is used to increase the cash patronage percentage above the 20 percent minimum. The cooperative will continue the current policy of not using debt to retire equity.

Alternative 2 focuses capital allocations on increasing cash patronage refunds. This alternative rewards current member business volume at the expense of capital accumulation for growth and equity servicing by increasing the minimum cash patronage refund to 75 percent of current member profits. The age of equity target remains at 5 years but the amount of cash dedicated to revolving aged equity is reduced by the increased minimum cash patronage requirement.

Alternative 3 is identical to the baseline except that the debt policy is changed to allow the use of debt to achieve the desired age of equity target. This alternative instantaneously adjusts the cooperative's leverage position to reflect the management teams desired equity position.

Alternative 4 changes the mechanism for redeeming equities from a 5-year revolving plan to a base capital plan with a $65/bale equity target. To maintain

comparability, the base capital plan will be based on a 5-year moving average of bales ginned. The purpose of this alternative is to smooth the year-to-year cash requirements for equity redemption. The 5-year revolving plan can have wide swings in cash required for equity redemption based on the volatility of past cooperative savings. The base capital plan smoothes the year-to-year swing in volumes over a 5-year period allowing for a more stable equity redemption requirement. This alternative also allows the use of debt capital to retire equity when needed. By maintaining a specified level of equity and using debt to maintain this equity level, the cooperative management retains control of the balance sheet, in terms of the way that assets are financed, and is not governed by past Board policies.

Under the baseline policy, all members are receiving a minimum of 40 percent cash patronage. Under the base capital alternative the cash patronage allocated becomes a function of the use-to-ownership ratio as described in Table 2. While the cooperatives actual use-to-ownership was not examined, for illustrative purposes this alternative assumes that 50 percent of the membership contributes 50 percent of the ginning volume but currently owns 70 percent of the equity in the cooperative. The other 50 percent of the cooperative's membership is assumed to have only 30 percent of the equity in the cooperative but half of the volume of business. Therefore, there is, at least initially, an imbalance between the use and ownership of the cooperative. As Table 2 indicates, when switching to the base capital plan, the members of the cooperative who are over invested will receive higher cash patronage refunds while those who are under invested will receive less cash patronage. As the use-to-ownership ratio becomes equal, members will receive an average cash patronage refund of 40 percent.

Simulated Financial Results for the Cooperative

Figures 3 through 6 illustrate the temporal dimensions of four critical financial performance variables for the cooperative for each of the alternatives relative to the baseline. These four variables are: 1) sales growth, 2) the solvency of the cooperative measured by the debt-to-asset ratio, 3) the liquidity position of the cooperative in terms of the term-debt coverage ratio; and 4) the profitability of the cooperative as measured by return on equity.

Figures 3 through 6 also give an indication of the risk exposure for the cooperative under each alternative. The bars in the lower portion of each graph show the probability of the particular variable falling below a specified target value. For example, the target volume growth for the case cooperative is 2 percent per year. The bars in the volume growth graphs indicate the probability that the cooperatives growth will be less than the 2 percent targeted growth. This view of risk for the cooperative is a value-at-risk concept. It indicates, how much downside risk the cooperative faces with respect to that particular measurement variable. The target values for the solvency, liquidity, and profitability variables are set equal to CoBank benchmarks. For solvency, the benchmark is 65 percent total debt to total assets. For liquidity, CoBank defines a term-debt coverage ratio of 1.5 as marginal and 1 as critical. The target was set equal to the marginal value of 1.5. The average return on equity for a ginning cooperative according to CoBank is 25 percent so that value was set as the target for the value-at-risk measure.

Alternative 1: Figure 2 illustrates the financial impacts from this alternative. Relative to the baseline, volume growth shows a significant decrease. The negative sales growth is due to the decrease in cash patronage and a resulting decrease in members' expectations of future cash patronage. The decrease in expectations of cash patronage results in members' perceiving an increase in the net price of ginning which reduces demand for the cooperatives ginning services, relative to the baseline. However, the increase in aged equity redemptions reduces member's expectations of the time it takes to receive the cash value of the equity credits and decrease in expected time reduces the discount effect on equity credit value. The increased value of equity credits over time results in faster growth in 2005 and 2006.

The debt-to-asset ratio does not change drastically with this alternative due to the cooperatives policy towards using debt. The slight decline in overall debt reflects the fact that the alternative needs less capital purchases in the earlier years due to the declining volume. The debt policy is also reflected in the liquidity position of the firm with the small changes in the term-debt coverage ratio reflecting the small decline in overall debt load relative to the baseline. It should be noted that, the large jump in the term-debt coverage ratio in 2003 reflects the payoff of a long-term note that had been acquired prior to the beginning of the simulation period.

The cooperative return on equity (ROE) for this alternative does not change significantly from the baseline. The cooperative does experience slightly lower returns in the earlier years due to the drop in demand associated with the lower cash patronage. However, by the later part of the simulation period the ROE for the alternative is slightly higher than the baseline.

The value-at-risk measures indicate the change in downside risk faced by the cooperative for each financial variable. Reducing cash patronage and increasing equity redemptions increases the probability of not achieving the target growth rate in 2002 from 62 percent under the baseline to 73 percent under the alternative, (Figure 2.1). The financial risk exposure in terms of solvency (Figure 2.2) and liquidity (Figure 2.3) remains very close to the baseline under this alternative. The target value of 25 percent is exceeded more than 50 percent of the time for both alternatives (Figure 2.4). The detrimental impact of this shift in policy on growth in the early part of the simulation could be a reason why many cooperatives, that have historically given large cash patronage refunds, are hesitant to commit a large amount of current profits to equity redemption.

Alternative 2: Figure 3 illustrates the financial impacts from this alternative. Relative to the baseline, sales growth is considerably higher under the alternative with first year growth being 4.7 percent relative to baseline growth of 1.7 percent. The annual growth rate remains higher until 2007 when members' expectations of the higher cash patronage have been fully incorporated. However, the decline in depreciation expenses in 2007 causes a rise in profitability, which increases member expectations of the value of future cash patronage leading to stronger growth. The growth rate effects of this alternative illustrate the quick, short-term gains that may be achieved by raising the cash patronage refund.

The average debt-to-asset ratio for the alternative is about 5 to 7 percentage points higher than the baseline throughout the simulation period. There are two primary reasons for this result. First, by distributing so much cash patronage, the working capital is held at a minimum in any one year. Therefore, if the next year results in a poor cash flow, then more debt will be needed than if additional cash had been reserved in the previous period. Second, the higher volume growth depletes the gin's excess capacity, which

increases the need for additional capital investments to meet the increasing volume. Because the cash from operations has been distributed back to members, the increased investment in assets must be made using debt-capital. The term-debt coverage ratio reflects the increased debt load for this alternative. However, the value-at-risk measures for both statistics show only marginal increases in downside financial risk.

The ROE for this alternative is considerably higher than for the baseline. The fixed cost nature of the cotton gin dictates the need for additional volume to improve profitability. The increased annual percentage growth in volume improves the overall volume for the gin by about 1,700 bales annually over the planning horizon. Because the cooperative has excess capacity, particularly in the early years, this additional volume comes at very low cost, thus improving the margins for the gin and increasing the return on equity relative to the baseline. The value at risk measure shows a slight decline in the probability of falling below the 25 percent ROE target, which is reflective of the rising mean level of ROE for this alternative.

Alternative 3: Figure 4 illustrates the financial impacts from this alternative. The main impact on the growth rate occurs in 2002 and 2003. The model borrows cash in 2002 to retire 5 years of old equity immediately. This sudden shock works its way through the member expectations and affects sales growth in 2003. The jump in sales growth increases the overall utilization of the gin, which increases profitability allowing for a greater growth than the baseline through 2005. From a value-at-risk perspective, there is almost no change in the probability of annual growth below 2 percent, relative to the baseline.

The large difference in debt in 2002 reflects the required borrowing necessary to retire all debt older than 5 years of age. This initial debt load coupled with a large equity allocation that comes due in 2004, keeps the mean debt-to-asset ratio above 50 percent until the final year of the simulation. With the benchmark of 65 percent, the increased debt-level results in very low probabilities of having serious solvency problems, with the highest probability being 11 percent in 2008.

From a liquidity perspective, the mean level of the term-debt coverage ratio is considerably lower for the alternative. This is to be expected because of the large increase in total debt load. Concern here may be with the value-at-risk numbers. While

the baseline shows no more than a 5 percent chance of being below the CoBank suggested benchmark of 1.5, the alternative shows double digit chances of being below this benchmark in 6 of the 9 years.

Alternative 4: Figure 5 illustrates the financial impacts from this alternative. Sales growth declines dramatically in the first year of the simulation relative to the baseline. The drop in sales growth is a consequence of changes in patronage allocation policy and changes in expectations of members. The sudden decrease in cash patronage for the 50 percent of the membership that is under invested (as detailed in Table 2) decreases their expectations and results in a substantially lower growth. By using debt to help realign the use-to-ownership, members' expectations adjust by 2003, and the growth rate exceeds the baseline through 2007. The value-at-risk measure for growth is substantially different from the baseline during only the first year. Once the new plan becomes incorporated in members' expectations, the growth rate and the probabilities of being below the target are very similar.

The debt-to-asset ratio is substantially higher at the beginning of the simulation period. The equity requirement of $65 per bale forces an adjustment in the cooperative's capital structure. The large difference in debt in 2002 reflects the required borrowing in 2002 necessary to retire all equity above the base target of $65 per bale. In addition, as volume increases, the added volume requires additional assets. Purchase of these assets will be financed with equity up to the target of $65 per bale and the remaining has to be financed by debt. Even though the debt-to-asset ratio is increasing, it still shows very little probability of going above the target benchmark of 65 percent and causing serious solvency problems. In addition, during the last four years of the simulation period the growth in the debt-to-asset ratio is beginning to level off as the cooperative reaches a stable capital structure position.

From a liquidity perspective, the mean level of the term-debt coverage ratio is considerably lower for the alternative because of the large increase in total debt load. However, the increase in debt is proportional to the increase in volume, which tends to increase profits. The result is that the term-debt-coverage ratio remains stable throughout the simulation and avoids sudden drops that increase the risk exposure beyond the liquidity target. The value-at-risk measure shows that the probability of falling below the

target is higher than in the baseline but it never shows probabilities above 10 percent in any year. As the new capital structure adjusts and member expectations stabilize, the probability of having severe liquidity problems actually decreases.

The ROE for Alternative 4 is greater than under the baseline. This is the result of the change in the capital structure. A larger proportion of debt, as long as it costs less than the return on the assets, should improve the ROE. The value-at-risk measures also show that Alternative 4 presents smaller probabilities of being below 25 percent return on equity. The improvement in ROE for Alternative 4 is more attractive considering the minimal increase in the cooperative's financial risk.

Present Value of Returns to the Cooperative and Its Members

The discussion above focused on the temporal financial outcomes and risk exposure for the cooperative. In this section, the results will focus on the impacts of the alternatives across the 9-year planning horizon. The results will be presented in a net present value framework. In addition, this section examines the impact on the members' cash flows. The ability to develop a cumulative distribution of the outcome variables is an advantage of stochastic simulation models that makes it possible to compare alternatives in terms of risk as well as expected return. Examining the net present value of the returns under uncertainty allows for better comparisons of the tradeoffs between each of the alternatives.

The net present value (NPV) of net savings, shown in the first column of Table 3, is a measure of the total profitability of the cooperative during the study period. Alternative 2 (increasing cash patronage to 75 percent) presents the highest mean NPV of net savings at $6.08 million. The rapid growth obtained at the beginning of the simulation period allowed Alternative 2 to reach higher levels of volume and take advantage of economies of scale, thus increasing net profits sooner than the other alternatives. Increasing margins and higher returns to members create a reinforcing circle of higher-cash-patronage-higher growth-higher profitability at least to the point at which maximum capacity is attained.

Alternative 4 presents the second best mean NPV. At $6.00 million, this alternative is slightly smaller than Alternative 2. The negative impact at the beginning of

the simulation, because of the change in equity redemption plans, causes volume to grow slower than in Alternative 2.

The other two alternatives (1 and 3) have similar mean NPV's of net savings as the baseline. In alternative 1 increasing equity redemptions, using only operating profits, takes more time to be incorporated into the expectations of members and the effect of increasing equity redemptions does not start to improve results until the end of the simulation. The volume and profitability of Alternative 3 are similar to the other alternatives but the sudden increase in debt at the beginning of the simulation period and the corresponding increase in interest expenses has a net negative effect on profit.

To help in comparing the risk/return tradeoffs of the alternative, all of the alternatives were analyzed using the stochastic dominance framework. No strategy was preferred by first-order stochastic dominance; indicating that using only the means to distinguish between the alternatives may not be correct if the Cooperative were risk averse. When restricting the set of decision-makers to only those that are risk averse, second-order stochastic dominance can be used. Again, there is no preferred alternative when using second-order stochastic dominance. However, Alternative 3 was dominated by second order by all the other alternatives. Therefore, based on the cooperatives' NPV of net savings, Alternative 3 would be a poor alternative relative to the other alternatives for all cooperatives that are risk averse.

The second column of Table 5 focuses on the age of equity for the base and the three alternatives that use a revolving equity plan. Alternative 1 decreases the average age of equity from 7.3 years in the baseline to 6.2 years. Alternative 3 presents the lowest value, 5.4 years, since it forces the cooperative to maintain equity at a 5-year life (except for the first year, which is why the statistic is not exactly 5) by using debt. Alternative 3 reduces the average age of equity almost a full year more than Alternative 1. Alternative 2 focuses on cash patronage and thus performs as expected with respect to age of equity by increasing the age from 7.3 in the baseline to 12.1 years. Under the base capital plan the age of equity is irrelevant as equity is redeemed based on over/under investment not age of the equity.

Finally, the net present value of net cash flows to members was analyzed to understand which alternative would provide the highest return to the members and what

the risk of those cash flows would be. The net cash flow to members is defined as the sum of all the cash patronage, equity redemptions and dividends received by members adjusted for a member in a marginal tax bracket of 28 percent.

As expected, Alternative 2 results in the highest mean NPV of cash patronage to the members as well as relatively low variability about the mean as indicated by a CV of 32 percent. The cooperative is dedicating most of its free cash to cash patronage before addressing equity redemptions. Therefore, cash patronage remains stable at 75 percent rather than bouncing from 40 to 80 percent as in the baseline when equity redemption demands vary from year to year causing cash patronage amounts to vary.

Interestingly, Alternative 1, which was focused on redeeming equity from operating profits, did not produce the highest mean NPV of equity redemptions to members. By using debt to redeem equity, Alternatives 3 and 4 did as well or better in returning equity to the members. The lower relative variability in equity redemptions for Alternative 3 compared to Alternative 4 is due to the disconnect between equity redemptions and operating performance for Alternative 3. Alternative 3 redeems equity when it comes due, irrespective of the performance of the cooperative. Alternative 4, on the other hand, attempts to maintain the same amount of equity from year-to-year, which is a function of operating profit. As such, Alternative 4 may be more volatile than Alternative 3 depending upon the volatility of operating performance.

In terms of total cash flows to members after taxes, Alternative 4 returns the most to members. The mean NPV is $4.25 million for Alternative 4 compared to the baseline of $3.49 million. The total cash patronage received by members is not as good as Alternative 2 but the capital restructuring allows the cooperative to increase equity redemptions enough to compensate for smaller up front cash patronage. This suggests that Alternative 4 might be the preferred choice for members. The initial reaction of the membership to this change in capital strategy hurts performance at the beginning of the simulation period but the cooperative recovers quickly and the use of debt allows the cooperative to increase equity retirements and total cash flows to members.

Alternative 3 presents the second best mean NPV of total net cash flows to members at $4.15 million, which is still greater than the baseline value. The total cash patronage to members is slightly higher than in Alternative 4 but the equity redemptions

are much smaller. Alternative 2 presents the third best mean cash flow to members, thanks to the large up front cash patronage returned to members. However, Alternative 2 is using all the cooperative's cash flows to pay cash patronage and there are not enough funds to redeem equities. Alternative 1 presents the lowest mean NPV of net cash flows to members. The low cash patronage returned to members is the main reason for the poor performance.

The NPV of total net cash flows to members was analyzed using the stochastic dominance framework. Using first-order stochastic dominance, Alternatives 2, 3, and 4 were all dominate over the baseline and Alternative 1. This result suggests that the baseline and Alternative 1 are the least preferred for all types of members regardless of their risk preferences. Alternatives 2, 3, and 4 were compared using second-order stochastic dominance. The results indicated that Alternatives 3 and 4 dominated Alternative 2 for all members who are considered risk averse. Taking into consideration the results at the cooperative level where Alternative 4 dominated Alternative 3 by second-order stochastic dominance, Alternative 4 appears to be the alternative that would provide members with the highest returns and lower risk while maintaining a sound financial position for the cooperative.

Summary

This research contends that cooperatives have a unique role to fill in the rapidly changing agricultural environment. However, many of the opportunities available to cooperatives require the ability to move quickly on investments that may require substantial capital. To take advantage of these opportunities, cooperatives must have sound control of their financial position. The lack of sound, flexible capital management policies for many cooperatives makes them vulnerable in this changing environment. This research has developed a methodology to assist cooperatives in analyzing the economic and financial consequences of alternative capital management strategies under uncertain conditions.

Previous simulation studies failed to consider members' responses to profit allocation and equity management policies. The methodology proposed here follows from the theoretical work done by Schmiesing in Cobia (1989) and uses consumer

demand and finance theory to fill the deficiencies of previous cooperative simulation models.

When members' responses are incorporated, the results suggest that decreasing cash patronage to increase equity redemptions is a poor strategy. Cooperative members favor cash patronage and any policy that reduces the current cash patronage results in a negative response from members. This result may help explain why many cooperatives do not have and/or follow a sound equity redemption plan. In addition, the particular cooperative used for this study had large unutilized capacity and large fixed costs. Therefore, any strategy that significantly increases volume improves the asset turnover ratio and enhances positive cash flow that offsets, somewhat, any increase in the percentage of cash patronage refunds. Increased cash patronage refunds can be particularly effective at boosting capacity utilization and spurring profitability in a relative short time frame. While, strategies that reduce cash patronage refunds can also have positive impacts on volume, the time frame before the effects are realized is generally longer.

Not surprisingly, the use of debt to increase equity redemptions seems to be a good strategy for members. The use of debt can also be good for the cooperative as well, especially in circumstances where the cooperative has a low initial debt to equity ratio. Modifying the capital structure of the cooperative allows equity retirements to be increased without having to lower the cash patronage to members. However, debt has to be used very carefully not to expose the cooperative to excessive risk. From the cooperative's perspective, using a base capital plan can improve the control of the balance sheet, improve profitability, and reduce the variability in cash flow demands. From the overall members' perspective, a base capital plan that uses debt to control the debt/equity mix in financing the cooperatives assets would result in the highest amount of cash flows to the membership at lower variability.

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Figure 1: STRES and Members' Response Addition Diagram

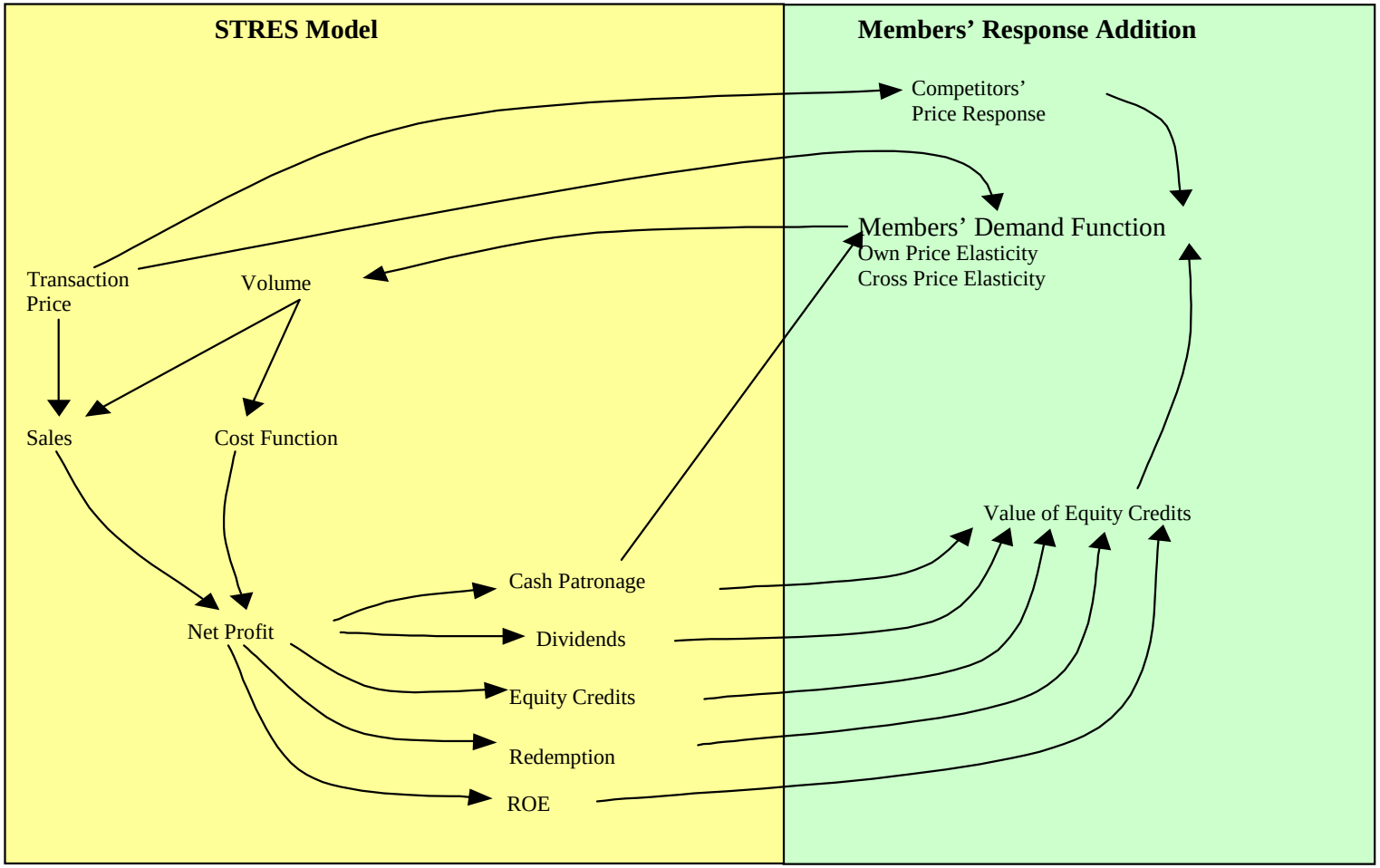


Figure 2: Alternative 1: Annual Financial Results for the Cooperative When Reducing Percentage Cash Patronage and Increasing Equity Redemptions

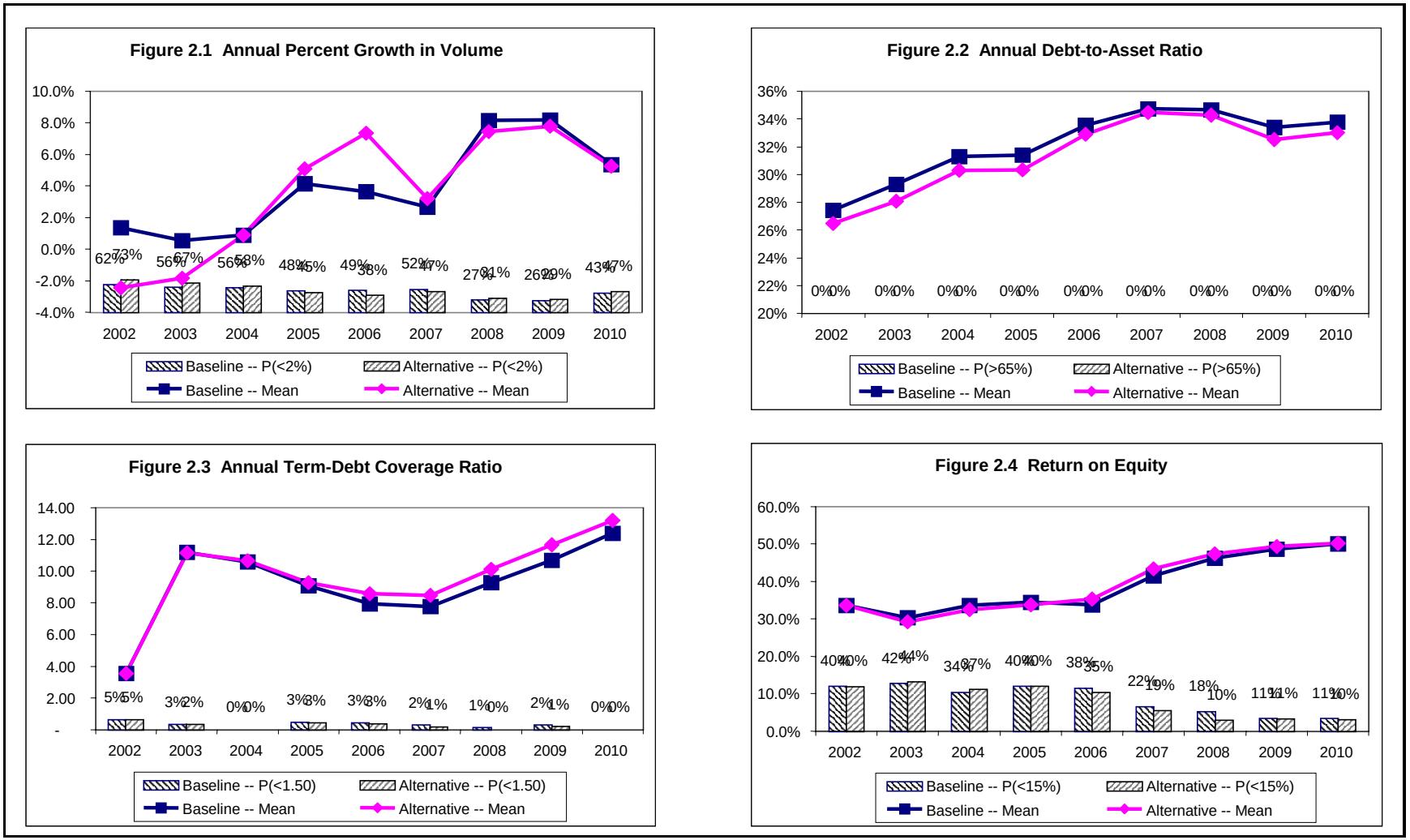


Figure 3: Alternative 2: Annual Financial Results for the Cooperative When Increasing Percentage Cash Patronage and Increasing Equity Redemptions

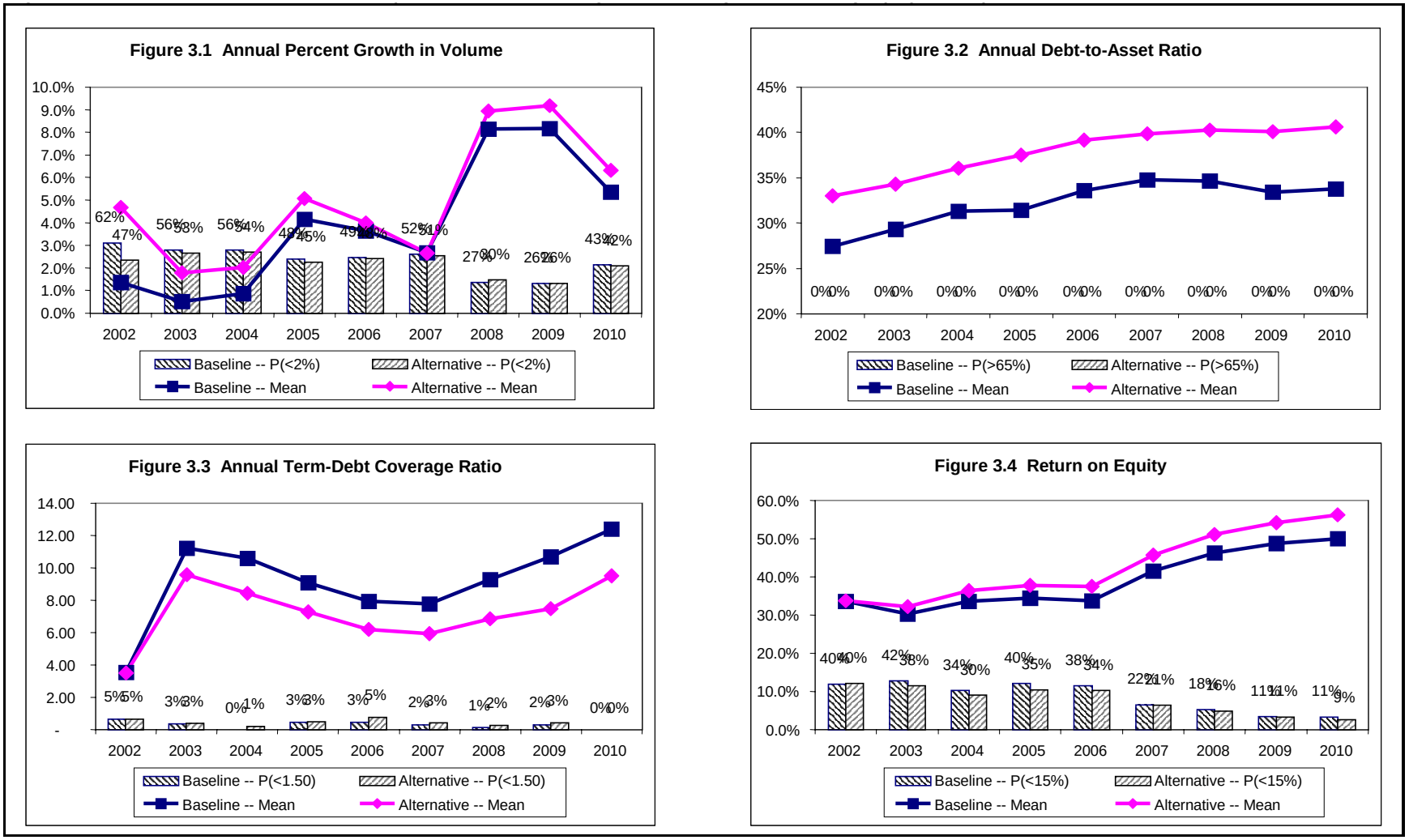


Figure 4: Alternative 3: Annual Financial Results for the Cooperative When Using Debt to Reach Age of Equity Target

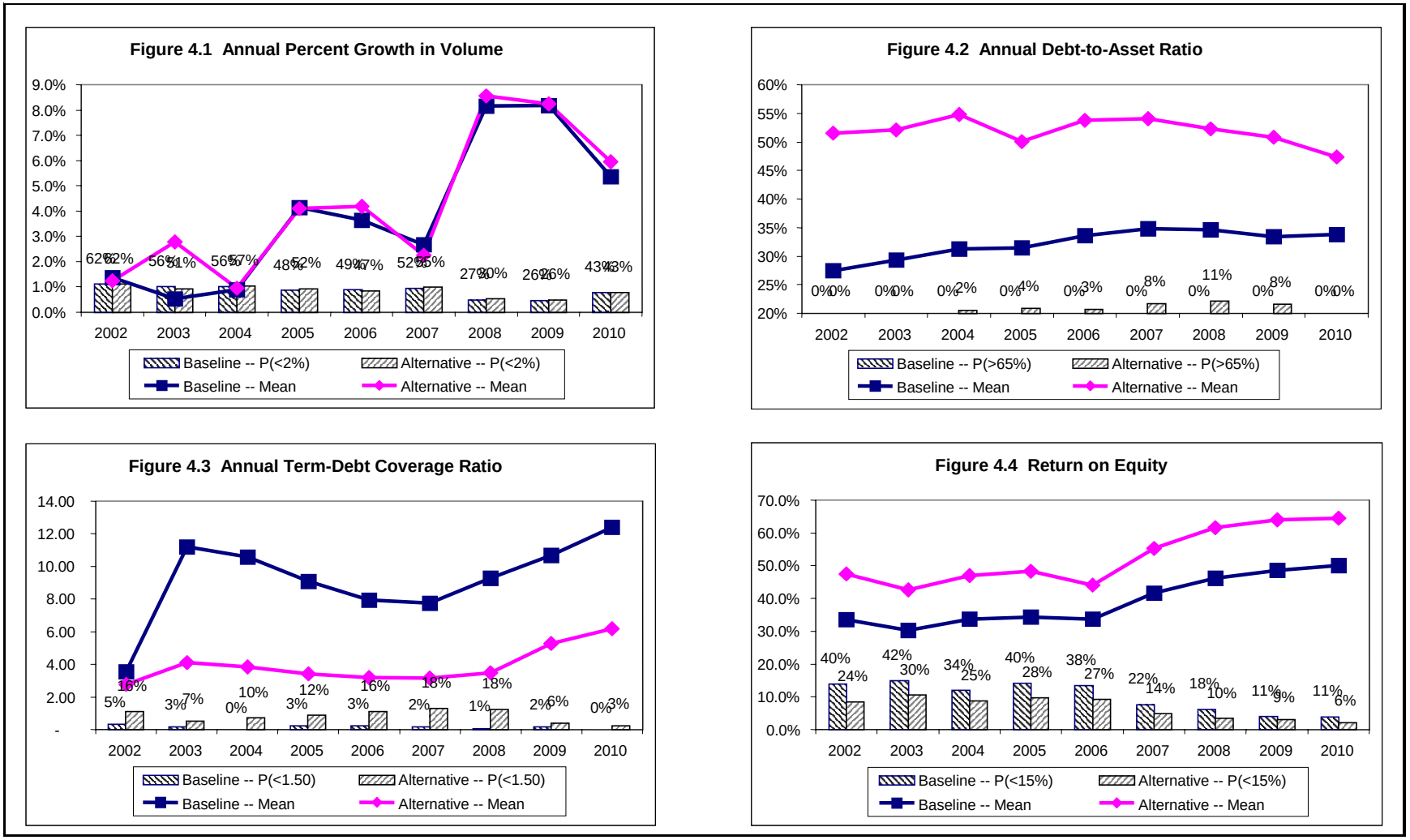
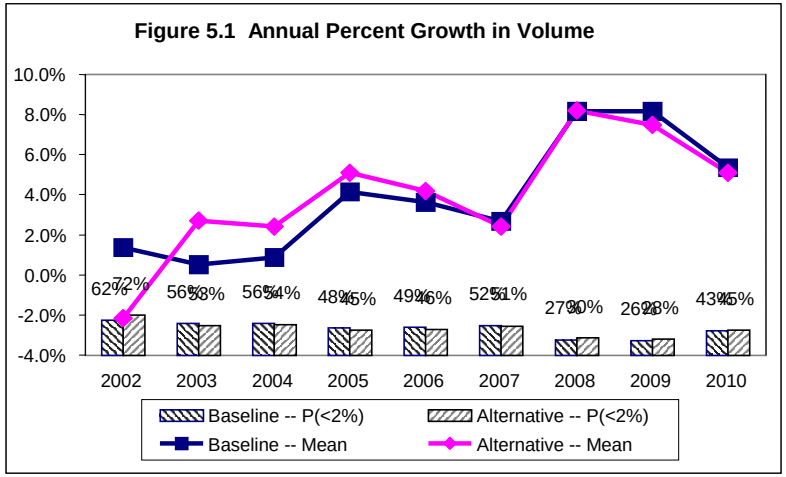
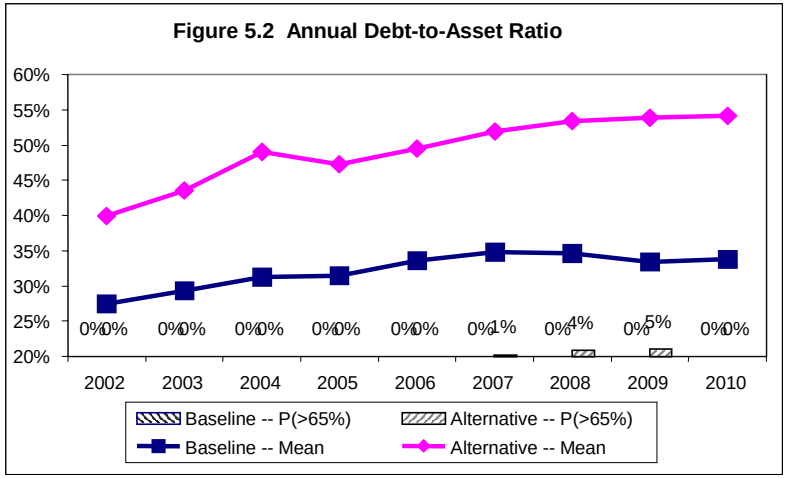
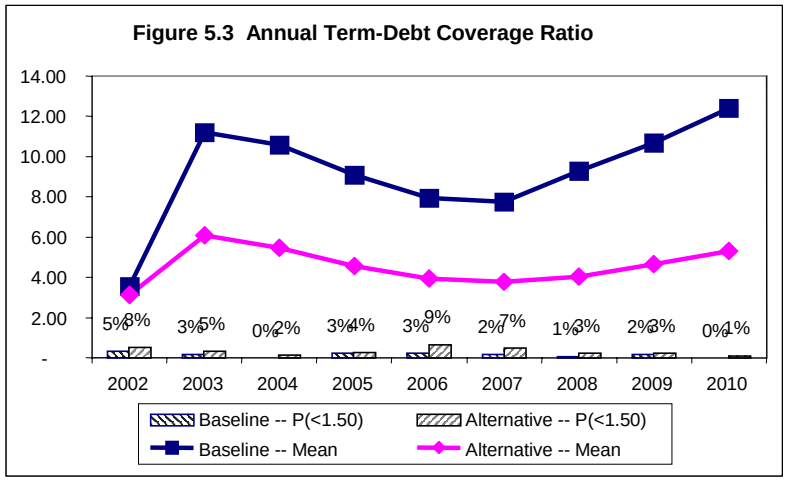


Figure 5: Alternative 4: Annual Financial Results for the Cooperative When Using A Base Capital Plan with Debt







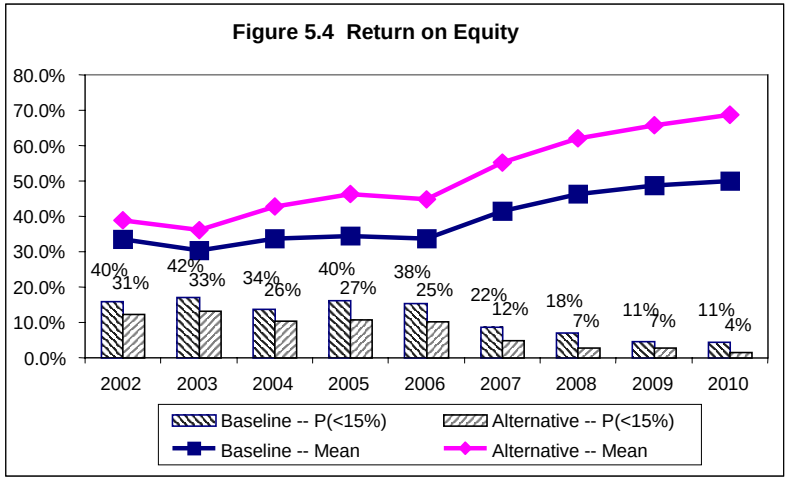


Table 1. Assumptions for the Alternative Capital Management Strategies

	Baseline	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Minimum Cash Patronage Refund Percentage	40%	20%	75%	40%	40%
Target age of Oldest Equity	5	5	5	5	N/A
Target Minimum Equity	$50/Bale	$50/Bale	$50/Bale	$50/Bale	$65/Bale
Use debt to pay equity?	No	No	No	Yes	Yes

Table 2. Base Capital Plan Cash Patronage According to Use-to-Ownership

Use-to-Ownership		Cash Patronage Payout Ratio
Min	Max	
0.00	0.60	100%
0.60	0.85	80%
0.85	1.15	60%
1.15	1.30	40%
1.30	Or larger	20%

Table 3. Present Value of Cooperative Income, Age of Equity and Cash Flows to Members over the Planning Horizon Under Alternative Capital Management Strategies

	PV of Net Savings	Average age of Equity	PV Cash Patronage	PV Equity Redemptions	PV of Total Net Cash Flows*
	($)	(Years)	($)	($)	($)
Baseline: 40 Percent Cash Patronage and Use Remaining Cash to Retire Equity					
Mean	5879090	7.3	2704374	2273773	3493296
Std Dev	1770573	1.0	1100789	423235	996704
CV (%)	30	14	41	19	29
Min	2505416	5.8	1002166	966919	1363673
Max	11136541	11.9	6040653	3186556	6214561
Alternative 1: 20 Percent Cash Patronage and Use Remaining Cash to Retire Equity					
Mean	5915936	6.2	2274646	2702634	3483166
Std Dev	1705709	0.7	1169545	347755	957300
CV (%)	29	11	51	13	27
Min	2424565	5.2	498021	1336490	1379852
Max	10883756	9.2	5697761	3385890	6052797
Alternative 2: 75 Percent Cash Patronage and Use Remaining Cash to Retire Equity					
Mean	6079382	12.1	4564785	760929	3793355
Std Dev	1983551	0.8	1480601	200398	1143504
CV (%)	33	6	32	26	30
Min	2495760	10.1	1871820	202421	1561326
Max	12227625	15.0	9170719	1292094	7086678
Alternative 3: Baseline Plus Use Debt to Retire Equity					
Mean	5806217	5.4	2948654	2669813	4150305
Std Dev	1867666	0.9	1235339	260122	937291
CV (%)	32	16	42	10	23
Min	2210790	4.9	900979	1683756	2048908
Max	10898294	11.3	6162442	3231249	6542556
Alternative 4: Baseline Plus Base Capital at $65/Bale and Use Debt to Retire Equity					
Mean	6002541	N/A	2447796	3321727	4253355
Std Dev	1621899	N/A	663241	731572	985019
CV (%)	27	N/A	27	22	23
Min	2460044	N/A	986917	1748155	2104313
Max	10319525	N/A	4277284	5261471	6945177

* Present value of total net cash flows is the sum of the present value of cash patronage and equity redemptions adjusted for the tax implications of members in a 28 percent marginal tax bracket.