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

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1 Introduction

Significant change is taking place in the agricultural industry. These dynamics are creating both challenges and 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 create new opportunities but also require investments in special processing equipment and distribution channels.

To take advantage of these opportunities the farmer-owned cooperative must have the financial flexibility to pursue new opportunities. Financial flexibility results from the cooperative maintaining control of its financial structure. Cooperatives, historically, have had trouble balancing financial stability while remaining competitive through cash patronage refunds and balancing user/owner relationships.

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 that they pay low cash patronage refunds which may hurt the relationship with its members and effectively reduce members' use of the cooperative. 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.

The most universal cooperative principle is service at cost. This principle is achieved by distributing profits based on use. It follows therefore, that ownership be based on use. Thus, the only way to maintain a user/ownership balance is to retire equity of over-invested members and increase the equity of under-invested members. Members, however, often do not recognize the value of profits allocated to them in the form of stock. In some instances this behavior is warranted based on the historical equity management strategies observed. In other cases, this behavior may be perception because the accurate financial information is required for an economic analysis. Allocating equity credits to members rather than cash can reduce the perceived benefits of doing business with the cooperative. A major challenge for many boards is to develop consistent plan for retiring over invested members' equity thus creating equity value for members/users while maintaining the economic viability of the firm.

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, controll the balance sheet and return on investment for future growth while maintaining ownership in line with use? 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).

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 and return on investment while maintaining the user-owner balance in a way that provides an acceptable level of financial risk. The methodology proposed here will model dynamically the asset capitalization of agricultural cooperatives with the ultimate goal of providing guidelines that helps reduce the cooperatives financial stress and adequately addresses the member-owner's needs. Specifically, this research will explore alternative capital management strategies for farmer-owned cooperatives. The most important contributions of this research are:

- Evaluation of the impacts 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.
- Introduction of risk to provide a more probabilistic picture of the financial decisions made by cooperative management teams.
- Recognizing the relationship between cash patronage, the value of cooperative equity, and the impact on future products or service demand.

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 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 four alternative capital management strategies for the West Texas cooperative.

2 Method of Analysis

A dynamic stochastic simulation framework was design to replicate the financial activity and risk facing a farmer owned cooperative. Simulation is a powerful methodology that mimics an economic system and allows for better understanding of the behavior of complex systems. Stochastic simulation is an even more powerful analytical tool since it allows incorporation of risk analysis. A stochastic simulation model can assist in understanding the risk consequences of different business strategies.

Simulation has been used in the past on several occasions and proved to be a useful tool to study cooperatives' investment, strategic management decisions, and equity management. Some previous research using simulation to study cooperatives' financial and strategic decisions are Bejerlein, (1977), Bejerlein and Schroeder, (1978), Gray (1998), Poray (1997), Laughlin (1999), and Barton et al (1995). All of this previous work has made important contributions but has failed to 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 1988, "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 objective will actually be achieved depends on the response of patrons."

The model proposed here builds on FRAN (Financial Risk Analyzer), a firm level stochastic model developed at Texas A&M (Gray, 1998). A members' simulation component is added to the stochastic simulation model of FRAN. FRAN 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. However, as mentioned above, the model does not consider members' demand responses to cooperative strategies.

The member behavior addition reflects what changes in income affect patronage, which in turn affects willingness to do business with the cooperative, which 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 adjusted endogenously for member patronage behavior. Members' responses are a function of their own price elasticity, cash patronage refunds, equity credits refunds, valuation of equity credit refunds, expectations of future cash and equity credits refunds, transaction price, 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 FRAN model.

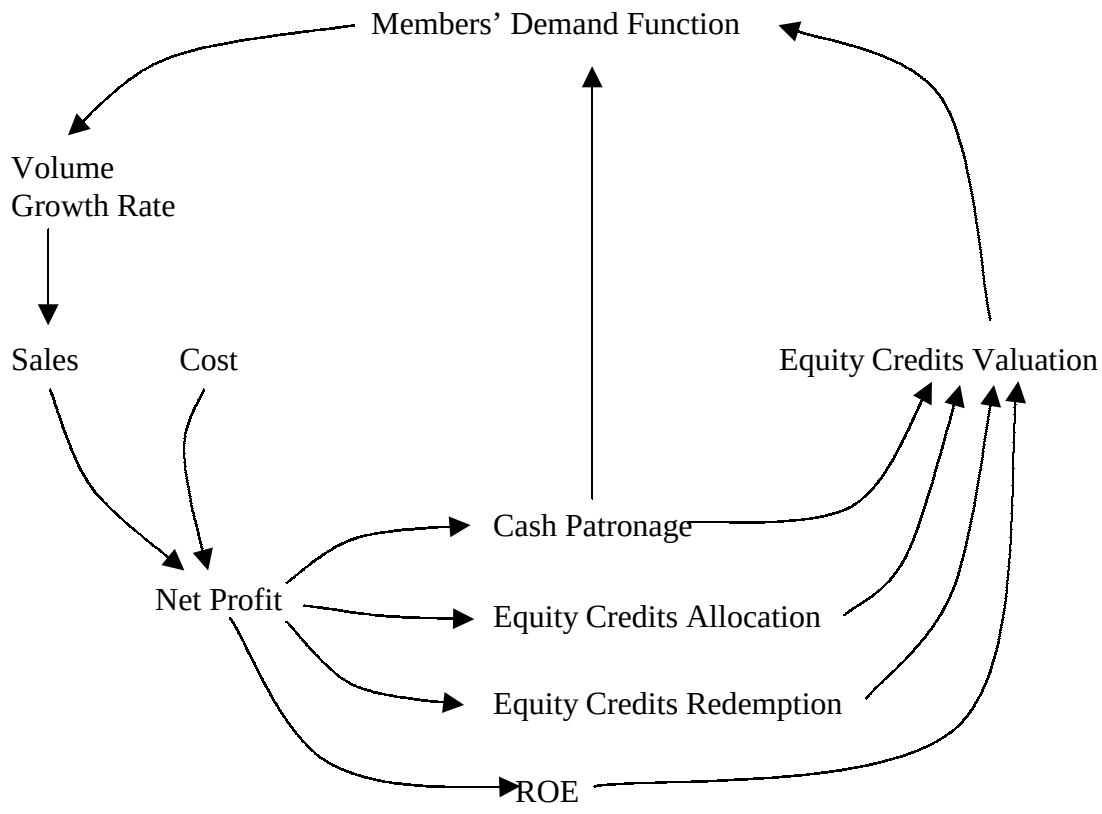

Figure 1: Members' Response Model Diagram

The derivation of the members response model starts with the regular demand function where changes in volume demanded depend on changes in net own price charged by the cooperative, own price elasticity, changes in price charged by competition and a cross price elasticity.

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

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

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 about a year later than the transaction, members must estimate the net price charged to them by forming an expectation of future patronage (Cobia, 1988). Equation 2 illustrates the member's formation of a net price (P_{net}). The expected price consist of the price charged at the time of the transaction (P_{trans}) and expected cash patronage (CPR) and equity credit values (EC.V.), 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.

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

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
$EC.V._t$	the value of the patronage refund paid in equity credits to the member at the end of the fiscal year t
r_m	member's discount rate

Substituting equation 2, equation (1) becomes

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

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 equity credits value. Each variable's expectation is formed by a weighted average of up to the previous 10 years CPR and allocated equity. Managers, boards,

and/or members could determine the weights. In summary, equations 4 and 5 indicate that a members' expectation for cash patronage and allocated equity credits received at the end of the fiscal year are formed based on the historical performance of the cooperative, with respect to, cash patronage and allocated equity credits.

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

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

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

$$VS_0 = \frac{DPS_1}{(\mathrm{Re} - g)} = \frac{EPS.(1-RR)}{(\mathrm{Re} - g)} = \frac{BVS.ROE(1-RR)}{(\mathrm{Re} - g)} \qquad (6)$$

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

Dividends per share is just 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 administrated, 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 on the additional investments and their ROE and as a consequence the expected dividend growth is high, increasing the value of the stock in equation 6.[1]

The same valuation principles could be used to determine the value of cooperative equity credits. The value of equity credits is just the net present value of cash flows that members will receive from those equity credits. One difference between cooperative equity and corporate equity is that a profitable cooperative is expected to redeem the equity back to members when no larger needed and based in use. Thus, one of the cash flows members will receive from owning equity credits is the book value of the equity credit at the time the cooperative decides to redeem equity. However, this is not the total cash flow that members will receive from the equity credits. The cooperative is giving equity credits to members because the cooperative is retaining 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

[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.

equity credits to members from the incremental earnings coming from the new business. Therefore, it is necessary to include the valuation of equity credits the cash flows from additional cash patronage and dividends that members expect to receive as a consequence of the cooperatives additional investments.

The valuation of equity credits is a function of the expected incremental value of cash patronage and dividends plus the discounted book value of equity. Equation 6 summarizes this relationship for an individual member.

$$ECV_{i,t=0} = \sum_{t=1}^{E[T]} \frac{E\lfloor CPR_{i,t} \rfloor}{(1+r_i)^t} + \sum_{t=1}^{E[T]} \frac{E\lfloor Div_{i,t} \rfloor}{(1+r_i)^t} + \frac{ECBV_i}{(1+r_i)^{E[T]}} \qquad (7)$$

Where

Div	total dividends paid to member I at the end of fiscal year t
ECBV	the book value of equity credits paid to member i
E [T]	the expected time horizon for equity redemption
r_i	member i 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. 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 can 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:

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

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
$s_{i,t}$	the share of business of member i year t

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

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

where

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

Substituting equations (9) and (10) into equation (11) the valuation of equity credits becomes

$$ECV_{i,t=0} = \sum_{t=1}^{E[T]} \frac{E[ROE_t]ECBV_i cr_t s_{i,t}}{(1+r_i)^t} + \sum_{t=1}^{E[T]} \frac{E[ROE_t]ECBVdr_t w_{i,t}}{(1+r_i)^t} + \frac{ECBV_i}{(1+r_i)^{E[T]}} \qquad (11)$$

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, and the expected time horizon and on the individual member shares of total business and total equity. For example, a year with a very good net profit and high patronage refunds will create an increase in the expectation operator and consequently will have a positive impact on the growth in volume. A bad year with a poor patronage refund will have a negative impact on member expectations resulting in a negative impact in volume growth.

High and low net incomes not only impact cash patronage expectations, they also affect the valuation of allocated equity credits through the expected return on equity (ROE). A low ROE will decrease the expected value of equity credits. A high ROE will increase the value of equity credits. The return on equity is the best financial indicator that members have to measure how good the cooperative has been 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 a good predictor of how good the cooperative will be in the future. Members should welcome additional investments in a successful competitively price 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 they will put more confidence on the cooperative investments and will give more value to the equity credits they receive from the cooperative.

Increases in equity redemptions will have a positive impact on the valuation of equity credits and therefore a positive impact on growth. To the contrary, a decrease in equity redemptions will negatively impact the valuation of equity credits and therefore decrease volume growth.

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 would have 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 counterbalance to some extent the cash patronage decrease effect. 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 doing business with the cooperative in the future. 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.

3 Model Application, Assumptions and Scenarios

The theoretical model described above was calibrated and applied to a West Texas Cotton ginning cooperative. The cooperative has a five year average annual revenues of $3.7 million. Ginning services account for 85% of the income and the rest comes from associated services such as transportation of cotton seed, compression and sampling fees. The five year average operating profit is $1.7 million and the 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% was nonqualified. The cooperative is extremely efficient in the use of its assets and equity with a five year average net margin of 22%, average return on assets of 21%, and a five year average return on equity of 41%.

Cotton ginning is a risky business given the weather characteristics of West Texas. The average number of bales ginned over the last 5 years was 35,480 bales with a coefficient of variation (C.V.) of 30%. Ginning costs are more stable given the large proportion of fixed costs. As a consequence, net profit is extremely volatile showing a C.V. of 52%.

The profit allocation policy followed by the cooperative is to return a minimum 46% as cash to patrons. In the past the cooperative has been able to pay an average of 50% of profits back to members in cash. Remaining earnings have been used to increase investment and to rotate members' equity allowing payments to old equity. The oldest equity is 9 years. All the retained earnings are allocated as qualified to reduce the tax burden of the cooperative. The board policy is to use debt only to finance fixed asset acquisitions. The cooperative does not use debt to retire aged equity or to manage the capital structure (debt to equity relationship).

The cooperative is expected to gin 40,000 bales in the first year of the simulation. Expected volume is assumed to increase at 2% per year, before any member responses are taken into account. Average weight per bale, at 494 pounds, is assumed constant throughout the simulation period. Burr extracted cotton is assumed to be 60% of the first year's volume, increasing 5 percent each year up to a maximum of 80% of total volume. Motes are sold for $0.12 per lb in each year of the planning horizon. All the cottonseed sales to PYCO, the main regional cooperative affiliate, are retuned to members. Per unit

fees for ginning are $2.10/cwt of field cotton the first year and increased $0.10 every two years. In addition, fees are generated from the following: compression at $8.25/bale, agent fees at $1.25/bale, marketing association at $1.38/bale, sampling at $1.50/bale, truck income at $5.00/ton. The cooperative is starting with $200,000 of working capital the first year.

In addition to these variables it was necessary to determine the own price, cross price elasticities, and the response of competitors to changes in the cooperative transaction prices. Ideally these parameters should be determined using a survey on members. However, this methodology is beyond the scope of this research. Parameter values were obtained by eliciting survey responses from the management team. 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.

The historical information and parameters described above were used to calibrate the model and obtain the results described in the next section. The results section has two parts. The first part compares the results of the FRAN dynamic simulation model, without members' response, to results when the members' response is incorporated. The second part uses the simulation model with member responses to compare the current profit allocation and equity redemption strategy for the cooperative with 3 alternatives polices. The objective of the scenario analysis is to evaluate the consequences of alternative empirical management strategies for the cooperative and its members.

4.1 Comparing Model Results without Members' Responses to that with Members' Responses

The purpose of this section is to illustrate the impacts of including member responses in the dynamic simulation model. The results in this section focus on the differences in the mean growth rate, volume, and profits for the model. In addition, this section will point out some of the idiosyncrasies of the cooperative situation and how these situations impact members' responses.

Figure 1 displays the mean results of the 10-year simulation for the cooperative with and without member response functions. Figure 1A illustrates the growth rate of

revenues under both cases. When no-member responses are incorporated, the cooperative growth rate is assumed constant at 2% per year. This constant growth rate is also reflected in the actual volume of cotton ginned where the volume grows linearly from 40,000 bales in year 1 to almost 48,000 bales by the 10th year. Net savings also grow over the 10 year period from an average $800,000 in year 1 to an average $1,550,000 by year 10 (Figure 1C). A Significant increase in the growth of profits starting in year 7 is due to a large drop in depreciation expenses that occur that year. The cooperative experienced a substantial fixed capital investment in the ginning operation in 1994 and that investment is completely depreciated by 2007. Since the simulation assumes a constant capital asset base, meaning that depreciation is immediately reinvested in assets, the level of depreciation and thus capital reinvestment drops in 2007 when the 1994 investment becomes fully depreciated. This significant increase in profitability has a big effect on the results when the member response functions are included.

As discussed in the methodology section, incorporating the member response functions requires a computation of the expected volume of cash patronage and the volume of expected allocated equity credits. Figure 1D illustrates these two variables for the cooperative. The large profits enjoyed by the cooperative 3 years prior to this simulation due to extraordinary good weather are dropped out of the expectation operator for the variables in year 2 of the simulation when this abnormally high profit is taken out expectations for cash refunds and value of equity credits decline to more normal values. The year to year changes in the expected patronage refunds and the value of equity credits determine the members expected patronage refunds and the members expected changes in the net price charged for ginning services. The expected net price of ginning coupled with the assumed elasticity of demand result in the growth rate shown on figure 1A for the simulation model when member responses are incorporated. The figure shows an average 1.25 percent drop in second year volume due to the decline in expectation of the membership (the drop in expected cash patronage and value of equity credits from year 1 to year 2). Of course, this leads to the lower volume of profits experienced in year in the results of the members' response model. The decline in profitability for year 1 and 2 leads to further decline in expectations for year 3 (Figure 1D).

This dynamic interaction continues for each year of the simulation. The growth in volume continues to be lower until year 7. In year 7, the effect of the drop in depreciation expenses increases profitability and increases members' expectations of cash and values of equity credits. This increase in expectations increases growth and profitability for the future. This suggests that many potential patrons would rather let current members pay for the large investment in 1994. Then they will use the cooperative to reap the benefits once the assets are paid for. This result illustrates the cooperative incentive that exists for members to own as little as possible but use alot.

While figure 1 illustrates the temporal effect of including member response functions, table 2 summarize the aggregate net present value effects and the risk associated with these aggregate measures. Since the no member response model does not suffer from the negative impact at the beginning of the simulation period the total net savings and total cash flows to members are slightly greater than the values in the case of the members' response model. In addition, the members' response model present a greater C.V. and also more extreme minimum and maximum values than the non-members' response model. Therefore, the members' response model is behaving as Schmiesing predicted. The response of patrons to the expected net price and not to the transaction price and the uncertainty in several variables that affect the cooperative's profits introduce an interesting interaction mechanism that creates instability in the system (Cobia, 1988).

Thus, this set of results illustrates the effect of including members' response function in the dynamics of the simulation model. By including these functions, the dynamic simulation model can do a better estimation of the impacts of alternative capital management strategies under risk. The next section will examine three such alternatives.

4.2 Evaluating Alternative Capital Management Strategies

This section describes the results of the simulation of the current cooperative policy (scenario 1) and 3 alternative policies. Table one shows the different profit allocation and equity redemption strategies analyzed. In the first scenario, the cooperative returns 46 percent of current year patronage in cash to members and then

uses remaining cash to retire equity, in a revolving equity plan, with the goal of achieving five year old equity; the cooperative currently has eleven year old equity. If additional cash is remaining after reaching five year equity target, the remaining cash is used to increase cash patronage above the initial cash patronage level of 46%. Under this base scenario, 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% of the asset value, and debt financing is used to cover any cash flow deficits from business loss). Table 1 summarizes the main assumption of the 4 scenarios.

Table 1: Assumptions for the Different Scenarios

	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Cash Patronage	46%	20%	75%	46%
Target Oldest Equity	5	5	5	5
Use debt to pay equity?	No	No	No	Yes

4.2.1 Scenario 2: Focusing on Equity Redemption

Scenario 2 focuses on equity redemption first. Instead of paying 46% of profits in cash, it pays the 20% minimum cash payment required to qualify the allocation. The remaining profits are used to maintain working capital and retire equity, thus reducing the age of the oldest equity to the desired Board target of 5 years. Debt is not used to retire equities in scenario 2.

Figure 2 illustrates the impacts of reducing cash patronage and increasing equity redemptions. Figure 2A shows this changes in policy affects the member expectation of cash patronage immediately and those expectations remain lower than the base scenario through out the ten year simulation period. This lower expectation for cash patronage will have a significant negative impact on volume growth for the cooperative of minus 4% during the fist year. However, the focus of this strategy is to reduce the age of the oldest equity thereby increasing the present value of equity credits. This strategy starts to give some results after the 4 year when growth rates get above 2 percent.

Figure 2B shows that the value of equity credits under this scenario is actually lower than under the base scenario. While using cash to pay old equities sooner reduces the expected time that the cooperative will keep members' equity (and thus, lowers the discount effect on book value of the equity credits) the increase in the value of the book

credits themselves is not enough to offset the loss in expected incremental cash flows associated with reduced cash patronage. Since the expected cash patronage declined as have in figure 2A, the incremental cash flow associated with the equity credits also declines.

The lower expectations for cash patronage and value of equity credits have a very large negative impact on growth in sales in years 2 and 3 because there are large amounts of aged equity and align age of equity to the target of five years requires large amount of funds. In the fifth year the amounts of aged equity is significantly less than in the previous years, this allows to increase the funds available for cash patronage payments. Starting in year 6, net profits increase because of the reduction in depreciations already explained, the value of equity of equity credits begins to rise rapidly, which increases members expectations of future returns and motivates a large use of the cooperative spurring growth.

The loss of volume growth in the first few years of scenario 2 significantly lowered the overall volume for the cooperative. The lower volumes lead directly to the reduced profitability shown in figure 2D. Thus, it appears that for the cooperative to focus almost entirely on equity retirements would be detrimental to large term profitability. In fact, table 3 shows the present value of net savings to be $438,000 lower than under the base scenario. While scenario 2 was able to lower the age of the oldest equity from 11 years the first year to 6 by the last year and decrease the average oldest equity by 1.5 years compared with scenario 1 average (table 3), the total present value of cash distributions to members dropped $463,000 because of the reduced profitability specially during the first 5 years.

4.2.2 Scenario 3: Focusing on Cash Patronage

Scenario 3 gives more emphasis to cash refunds than scenario 1. Scenario 3 pays 75% of net profits in cash refunds back to members leaving fewer funds available to retire mature equities.

Figure 3 illustrates the impacts of increasing cash patronage from current levels. Expected cash patronage in each year is about $5/bale much higher than the base scenario (figure 3A). The value of equity credits is about $2.5/bale lower than the base scenario.

Since the amount of equity credits being issued has dropped from the standard 54% in the base scenario to 25% under scenario 3 the result is less cash available for equity redemptions and increases the age of oldest equity by almost 3 years from 8 to 11.4 (table 3). The older equity increases the expected time before the equity credits issued are redeemed, which further reduces the value of equity credits. However, the incremental cash flow from the equity credits are expected to be quite high since the cash patronage ratio is set at 75 percent. Thus, some of the reduction in the value of equity credits is offset by the higher expected cash flows.

The higher expected cash patronage in the current period more than offsets any drop in the value of equity credits under scenario 3. Thus, the growth rate under scenario 3 is 1 percent to 0.5 percent higher than the base scenario, particularly in the earlier years as patrons react to the large increase in cash patronage relative to history. Of course, the higher growth rate leads to more volume, which leads to higher net savings (figure 2D and table 3). In fact, scenario 3 has the highest present value of net savings for the cooperative and the highest present value of cash patronage to members despite the fact that equity redemptions are much lower than in scenario 1. This illustrates how an aggressive cash patronage policy favors current patrons over past patrons. The scenario may overstate the benefits of increased cash patronage if the cooperative has an effective capacity constraint. By paying 75 percent in cash patronage the cooperative is left with very little equity to grow the asset base. If the revenue growth created by the increased cash patronage were more than the capacity of the current assets then the strategy of increasing cash patronage would be less effective.

4.2.3 Scenario 4: Using Debt to Pay Overdue Equities while Maintaining Large Cash Refunds

Scenario 4 is the same as base scenario 1 except for the debt policy. Scenario 4 allows using debt to pay equities older than 5 years. Under all scenarios the cooperative also has a requirement that equity will not fall bellow $50/bale.

Figure 4 illustrates the effect of allowing debt to pay over due equity and change the debt to equity ratio or capital structure of the cooperative. Since scenario 4 presents the same cash patronage payout ratio as the base scenario, 46%, the members'

expectation of cash patronage refund is very similar in both scenarios (figure 4A). The use of debt does not alter the cash patronage refunds but is does modify the valuation of equity credits compared with scenario 1. The use of debt at the beginning of the simulation period produces an increase in equity redemptions and reduces the time horizon for which equity credits book value are discounted compared to scenario 1 (table 3). As a consequence the expected value of equity credits is increased. This increase in expectations is particularly significant in the beginning of the simulation when there are large amounts of aged equity that is retired strengthening the use of debt capital (figure 4B). The increase in expected present value of equity credits produces a jump in the volume growth rate of scenario 4 at the beginning of the simulation as shown in figure 4C. The higher growth rates in volume, attained thanks to the use of debt, allow scenario 4 to present a larger volume of sales at the beginning than the base scenario. However, after the initial increase in equity payments and the consequent increase in members' expectations and growth, member do not receive any other equity payment or cash patronage payment substantially different from the base scenario, therefore, the behavior of both scenarios becomes pretty similar for the rest of the simulation.

Even considering that scenario 4 policy has a better response from members at the beginning of the simulation than the base scenario and that those better responses allows scenario 4 to increase volume more than scenario 1, the net profits of scenario 4 are slightly lower than net profits in the base scenario through out the period of analysis. This is the result of higher interest payments that have to be paid and that reduces the future net profits of the cooperative.

Scenario 4 allows the second greatest net present value of total benefits to members since the use of debt allows increasing equity redemption cash flows to members and as a result it increases the net present value of total cash flows returned to members.

Comparing the NPV of net profits none of the presents stochastic dominance over the other scenarios. However, when comparing the NPV of cash flows to members, scenarios 3 and 4 1first order stochastically dominates the others.

5 Conclusions

The previous studies that have used simulation have failed to taken into consideration demand responses to cooperative capital strategies. The methodology proposed here follows from the theoretical work done by Schmiesing and Cobia and uses regular demand and finance theory to fill the deficiencies of previous cooperative simulation models.

As demonstrated by the results, a simulation model that ignores members response could overestimate revenues and profits in cases where cash patronage or profitability decreases or could underestimate sales and net profits when cash refunds and profitability is increased making equity credits more valuable. It is also important to notice that a model that ignores member potential response will underestimate the volatility of the performance variables and therefore underestimate the real risk that cooperatives face.

When members' response is incorporated, the results suggest that increasing cash patronage seems to be preferred to increasing equity redemptions according to the growth rates obtained comparing scenario 3 (75% cash refund and equity rotation of 12 years) to scenario 2 (20% cash refund and equity rotation of 8 years).

The use of debt to increase equity redemptions seams to be a good strategy for members, especially in circumstances where the cooperative has a low debt to equity ratio as in the case for this West Texas cooperative. However, these benefits could diminish in the long run as interest payments increase and the net profits are reduced.

The particular cooperative used for this study has a large unutilized capacity and large fixed costs. Therefore, any strategy that significantly increases volume improves the asset turnover ratio and has a significant positive cash flow impact that offsets the increased cash out flows. This explains some of the benefits of scenarios 3 and 4 over the base situation. Further examples are needed to test how well strategies 3 and 4 would work when the cooperative was operating at full capacity. In this case additional sales would require additional investments in assets to handle the increased sales. Otherwise the cash distributions to the membership would result in increases in demand for the cooperative's services but no capacity to meet that demand, which would then reduce the benefits of increased cash to the membership.

This reports assumes that current members will also operate in the future. It does not incorporate the results of members operating in different phases of the production horizon. In the future the model of members should be expanded to allow multiple type of members responses. Different members with different balance of equities and use, tax brackets, individual growth rates and discount rates will value equity credits differently and the aggregate results of the different responses could be different from the all members response simulated in this research.

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Figures 1: Selected Variables to Show Differences between Non-members Response and Member Response Model

Figure 1A: Growth in Sales

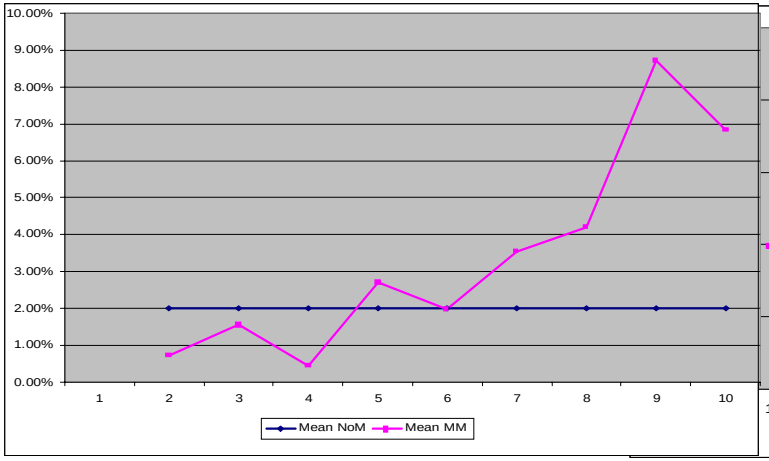


Figure 1B: Cotton Bales

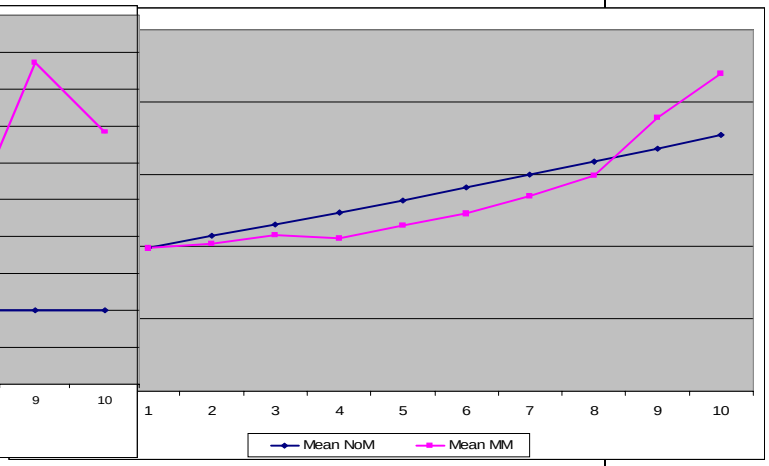


Figure 1C: Net Savings

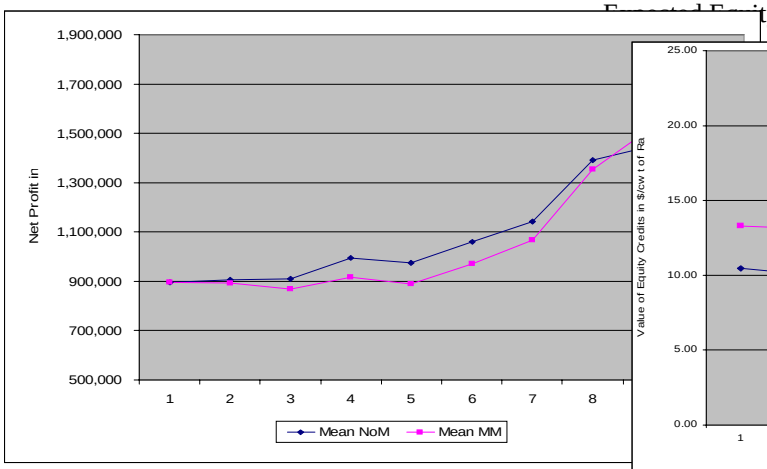


Figure 1D: Total Expected Cash Refund and Value of Expected Equity Credits

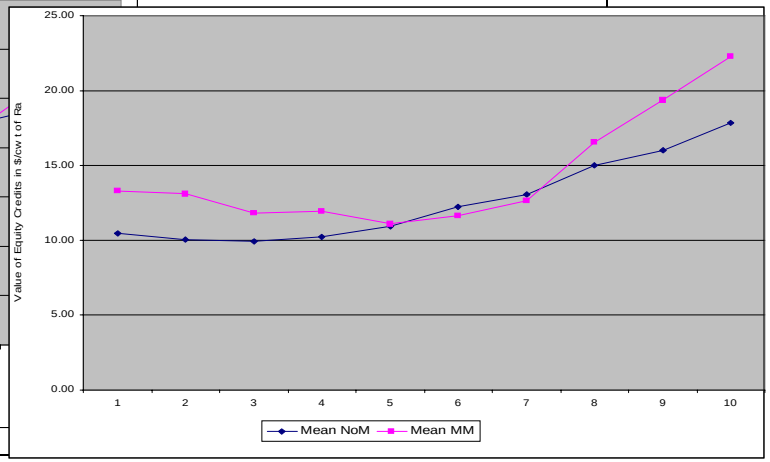


Table 2: Total Net Income and Total Cash Flows to Members

	PV of Net Savings	Average Oldest Equity	PV Cash Patronage	PV Equity Redemptions	PV of Total Cash Flows
No Members' Reactions					
Mean	5,266,257	7.8	2,662,048	2,221,134	4,883,181
Std Dev	937,855	1.3	589,829	362,155	890,364
CV	18	16.7	22	16	18
Min	2,234,432	5.8	1,375,241	853,929	2,229,170
Max	7,697,569	16.3	4,338,785	2,910,054	7,248,839
Members' Reaction					
Mean	5,137,251	8.0	2,680,492	2,093,326	4,773,818
Std Dev	1,549,391	1.3	1,052,371	474,962	1,446,530
CV	30	16.1	39	23	30
Min	924,920	5.8	603,993	539,150	1,143,142
Max	10,011,145	12.2	6,451,742	2,966,415	9,418,156

Figures 2: Selected Variables to Show Differences between Scenario 1 and Scenario 2

Figure 2A: Expected Members' Cash Refund

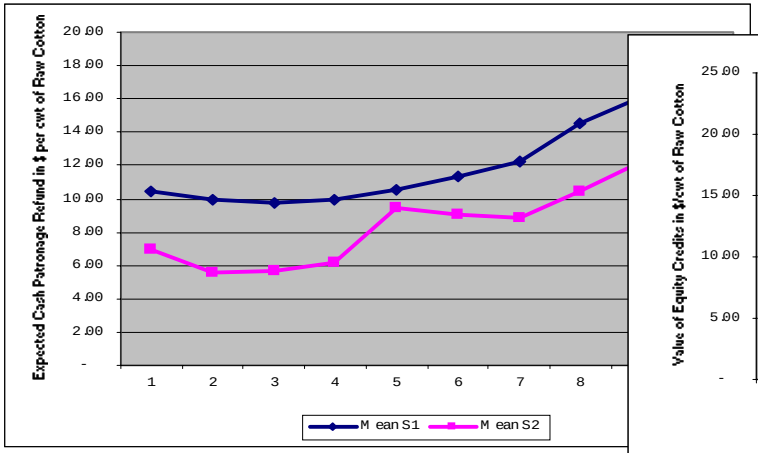


Figure 2B: Expected Members' Value of Equity Credits Refund

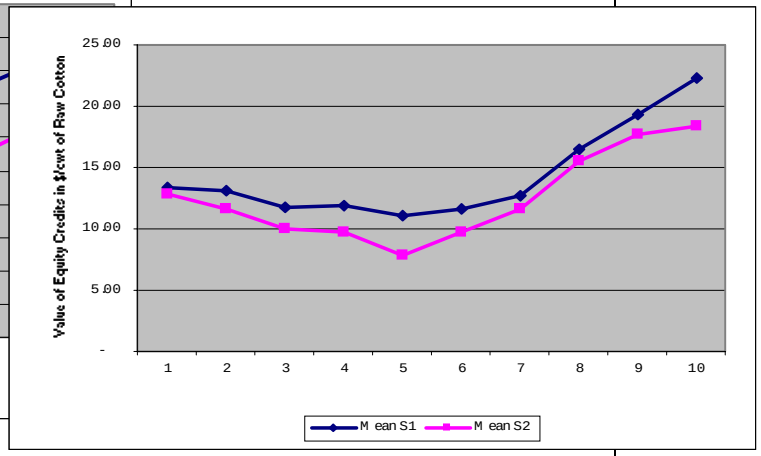


Figure 2C: Growth Rate in Sales

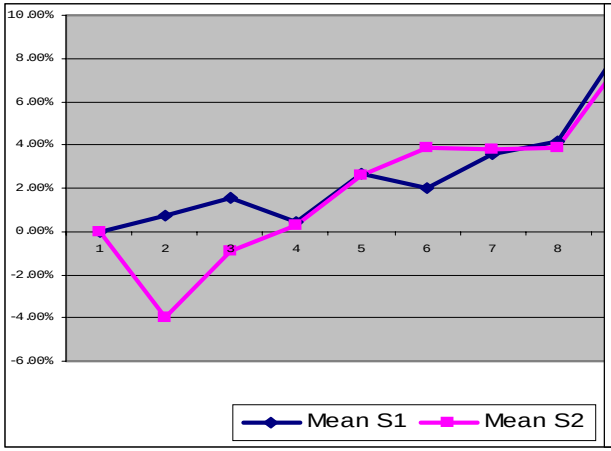
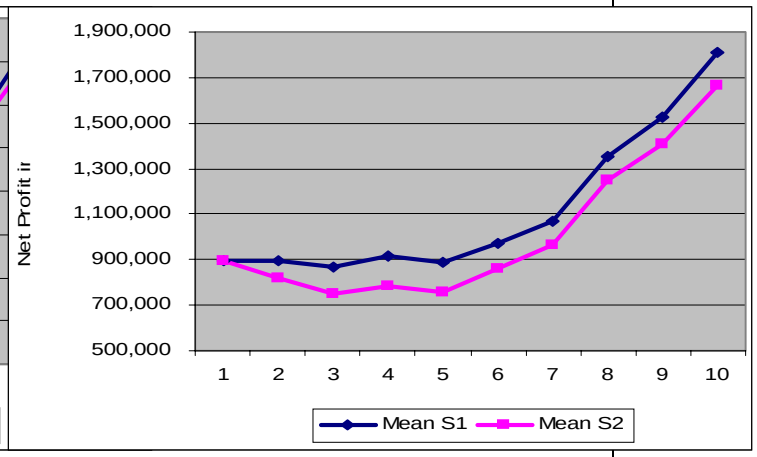


Figure 2D: Net Profit



Figures 3: Selected Variables to Show Differences between Scenario 1 and Scenario 3

Figure 3A: Expected Members' Cash Refund

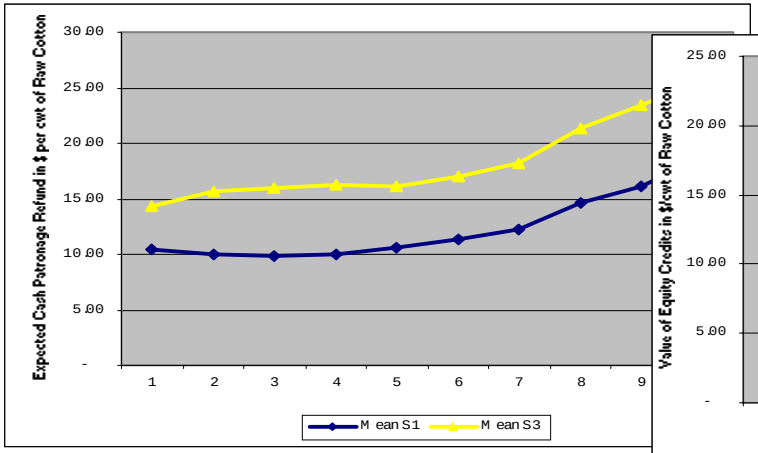


Figure 3B: Expected Members' Value of Equity Credits Refund

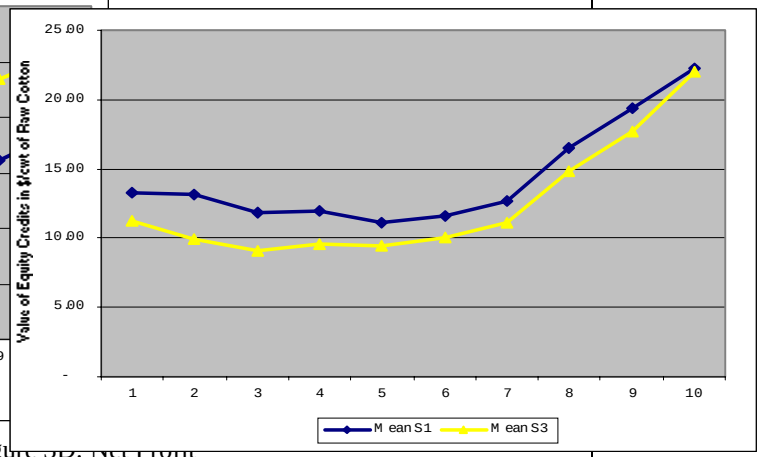


Figure 3C: Growth Rate in Sales

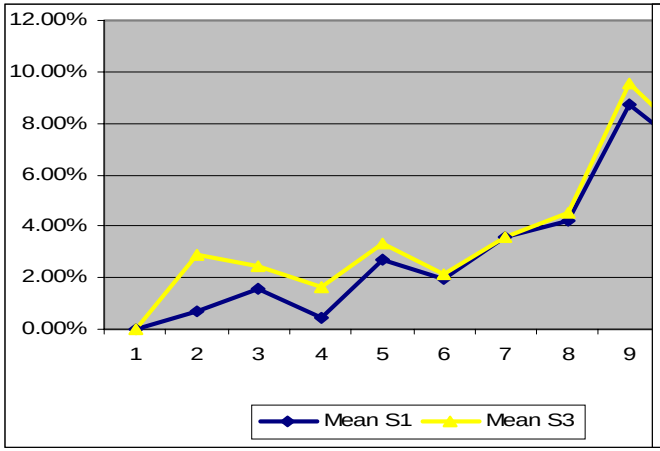
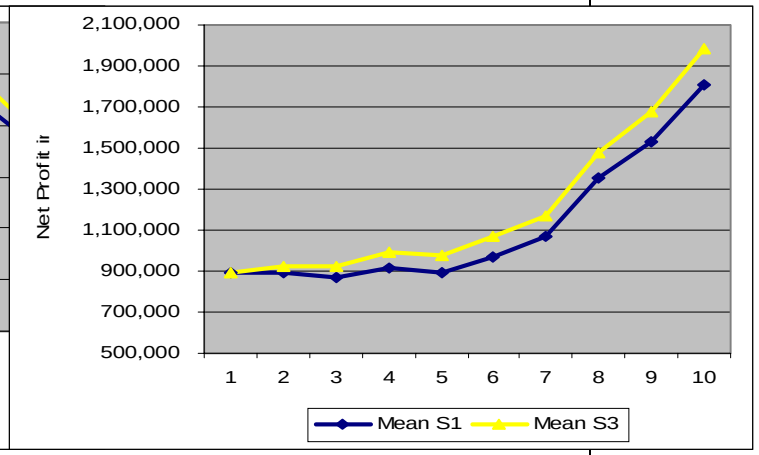


Figure 3D: Net Profit



Figures 4: Selected Variables to Show Differences between Scenario 1 and Scenario 4

Figure 4A: Expected Members' Cash Refund

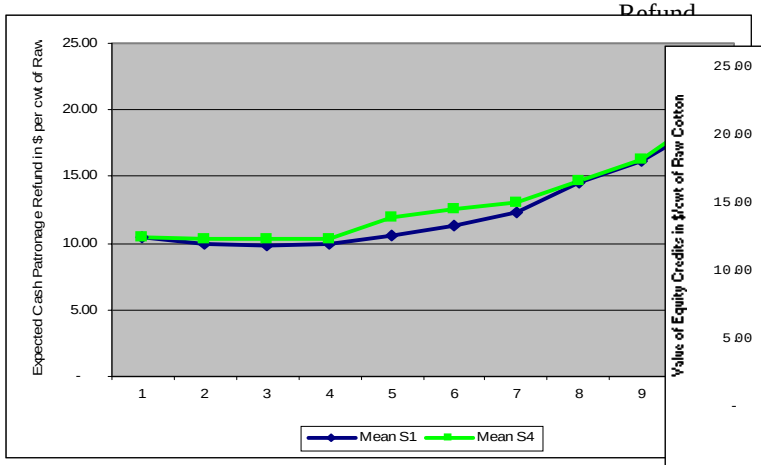


Figure 4B: Expected Members' Value of Equity Credits Refund

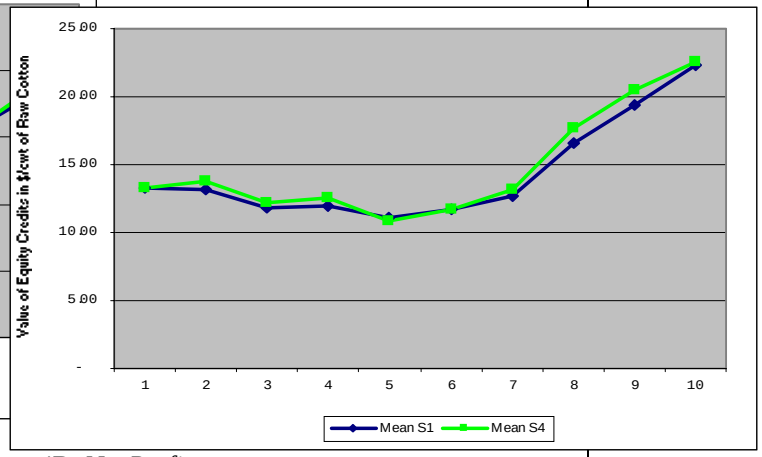


Figure 4C: Growth Rate in Sales

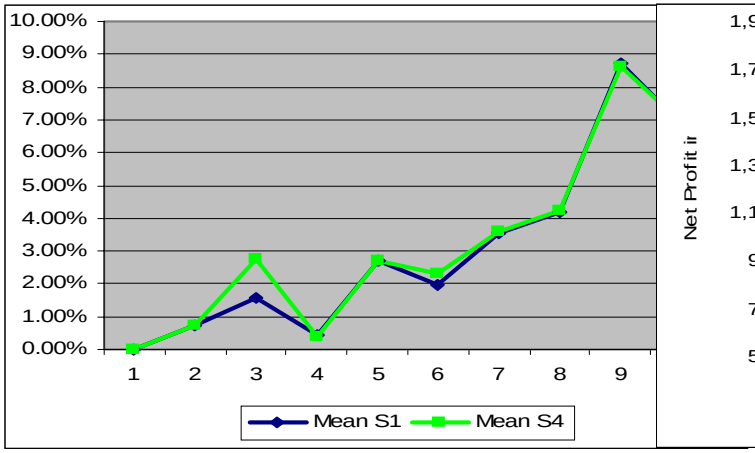


Figure 4D: Net Profit

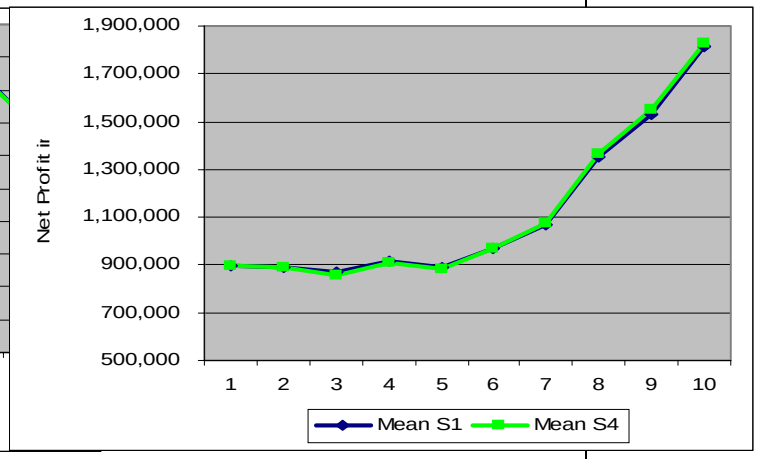


Table 3: Total Net Income and Total Benefits to Members

	PV of Net Savings	Average Oldest Equity	PV Cash Patronage	PV Equity Redemptions	PV of Total Cash Flows
Scenario 1					
Mean	5,137,251	8.0	2,680,492	2,093,326	4,773,818
Std Dev	1,549,391	1.3	1,052,371	474,962	1,446,530
CV	30	16.1	39	23	30
Min	924,920	5.8	603,993	539,150	1,143,142
Max	10,011,145	12.2	6,451,742	2,966,415	9,418,156
Scenario 2					
Mean	4,674,642	6.8	1,878,215	2,468,269	4,346,484
Std Dev	1,480,587	1.2	1,070,439	432,381	1,382,151
CV	32	17.6	57	18	32
Min	852,066	5.2	254,663	840,618	1,095,281
Max	9,487,316	11.5	5,815,552	3,109,677	8,925,229
Scenario 3					
Mean	5,487,879	11.4	4,160,540	951,004	5,111,544
Std Dev	1,653,510	1.2	1,269,812	275,701	1,536,863
CV	30	10.7	31	29	30
Min	971,565	8.8	1,002,622	190,000	1,192,622
Max	10,490,370	17.7	8,235,267	1,613,426	9,848,693
Scenario 4					
Mean	5,136,492	8.8	2,825,457	2,182,790	5,008,246
Std Dev	1,567,740	2.9	1,081,817	431,614	1,425,301
CV	31	33.1	38	20	28
Min	832,461	5.4	587,987	816,916	1,480,018
Max	9,979,509	20.3	6,620,268	2,898,828	9,519,097