INVESTIGATING ENTERPRISE RISK MANAGEMENT IN THE CONTEXT OF GRAIN AND FARM SUPPLY COOPERATIVES

By

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Abstract: Enterprise risk management (ERM) provides a framework for risk management that assesses and analyzes the broad spectrum of risks facing an organization and considers the organizations capacity to withstand risk and appetite for risk. ERM has not been previously applied to agricultural cooperatives but these producer-owned firm could benefit from ERM based strategies. This research investigates how the principles of ERM could be applied to grain marketing and farm supply cooperatives. The research measures and models the major risk areas facing these firms, investigates the correlation between risk components, determines the impact of each risk area on the cooperative's overall risk and investigates the impact of management decisions such as profit distribution and equity management on the cooperative's ability to withstand risk. The research uses historical data from 10 case-study Oklahoma cooperatives and a cooperative simulation model developed at Oklahoma State University. The results indicated that, on average, variation in grain volume was the largest source of risk followed by variation in grain margin and variation in fertilizer margin. The research found substantial variation in risk impacts across the case study firms. The results also indicated that profit distribution and equity management decisions had substantial impact of the cooperative's ability to sustain risk.

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CHAPTER I

INTRODUCTION

Agricultural cooperatives play a vital role in U.S. agribusiness and function as an extension of farm businesses. There are nearly 30,000 U.S. cooperatives operating throughout the U.S. with more than $3 trillion, in assets (Deller et al., 2009). These user owned firms account for nearly $654 billion in revenue, return $79 billion in patronage refunds and dividends, and create over 2 million jobs (Deller et al., 2009). In Oklahoma there are over 200 different cooperatives; of which, 64 are farm supply/marketing cooperatives. These 64 cooperatives create over $700 million in revenue, are comprised of over 38,000 members and employ over 1,250 people (Deller et al., 2009). In addition to their roles in U.S. Agribusiness, cooperatives function as an extension of farm businesses by helping producers manage risk. Agricultural cooperatives help producers achieve economies of scale and scope in sourcing inputs and in marketing and handling commodities. Cooperatives can also help producers reduce and manage risk associated with their farming operation by pooling commodities and/or input purchases and by offering options like forward pricing and pricing contracts (Kenkel & Parrish, 2013). Fluctuations in grain prices, grain volume, fertilizer price, fertilizer volume, fuel price, fuel inventory and other farm supplies represent major sources of for grain marketing and

farm supply cooperatives. These producer-owned firms could benefit from better understanding of the risks facing their cooperatives.

Enterprise risk management (ERM) provides a framework for risk management that assesses and analyzes the broad spectrum of risks facing an organization. An important aspect of the philosophy of ERM is that risk management should be integrated across the organization rather than in individual "silos" of business activity. ERM also includes the entire spectrum of risks including hazard risks, financial risks, operational risks and strategic risk. ERM provides a transparent understanding of the risk facing an organization and how multiple risks can simultaneously impact the firm. It also considers an organization's risk appetite and capacity. Due to these contributions, ERM is becoming an essential and expected best management practice for major publicly traded firms (Brodeur et. al., 2010).

ERM could be an extremely valuable tool for agricultural cooperatives. Farmer owned cooperatives face unprecedented risks due to input and commodity price fluctuations. CoBank and other lenders are requiring their cooperative borrowers to increase risk capacity by substantially increasing equity and/or changing business practices to transfer risk to the customer members. Because this equity must be generated out of the profit stream, these strategies have implications for cash patronage and the cooperative's ability to redeem previously issued equities. Unlike other agribusinesses, a cooperative's owners are also customers and risk management strategies that transfer risk from the firm to the customer do not meet the overall needs of the customer owners. In order to implement ERM, cooperatives need quantitative analysis of the risks facing the firm and the impact of risk mitigation strategies on the cooperative

and member owner. This allows for a better understanding of how each enterprise impacts the overall structure of the cooperative.

Research Objectives

The overall objective of this research is to apply the principles of ERM to grain marketing and farm supply cooperative. This is accomplished through four specific objectives: (1) To model the major risk areas impacting grain marketing and farm supply cooperatives, (2) To investigate the correlation between risk components (3) To determine the impacts of each risk component on the cooperative's overall risk and (4) to determine the impact of management decisions such as profit distribution and equity revolving period on the cooperative's capacity to withstand risks.

CHAPTER II

REVIEW OF LITERATURE

Enterprise Risk Management

Risk management has always been an important topic for agricultural cooperatives and other agribusinesses because they operate in risky environments. While investor owned agribusinesses have incorporated both traditional and more innovative risk management tools, agricultural cooperatives have been slower to adopt more complex risk management practices (Manfredo, Richards, McDermott 2003). The slower adoption of more complex risk management practices by agricultural cooperatives could be because the boards of directors are unfamiliar with these techniques or because they have incomplete understanding of the risks facing the cooperative. Either of these possibilities suggests a need to investigate the risks facing agricultural cooperatives and how ERM could be applied to these firms. Puccia, Ingram, and Dreyer (2008) and other authors argue that ERM can be an effective way to create a strong strategic risk management function that can cover the entire enterprise. However, they also state that ERM is often underfunded and under integrated throughout the firm.

There are several factors that suggest that ERM could represent an opportunity for agricultural cooperatives. First a number of new contingent clam contracts have become available in the capital market (Pilcher, Burkart, and Edmond 2011; Zeuli 1999). These contracts make it possible for cooperatives to mitigate risks in prices, commodity volume and even weather. Furthermore, recent advancement in technology proves modeling tools that can run complicated risk analysis for multiple areas of risk like: hazard, catastrophes, financial, interest rates movements, and other risk (D'Arcy 2001). These technologies make it easier for a cooperative board of directors, or other decision makers to understand the risk facing the firm and to apply the eight interrelated components of ERM in an efficient manner (Steinberg et. Al., 2004).

The advancement of these modeling technologies allowed Manfredo, Richards, and McDermott (2003) to conduct simulations to describe the effects of different size of coop, key risk factors, specific risk strategies started an evaluation of procedures (2003, p. 2). This simulation approach provides a foundation for the current research on applying ERM to agricultural cooperatives.

Background on Cooperative Structure

As stated previously, U.S. agricultural cooperatives are firms owned by their member owners. Those member-owners are agricultural producers who do business with the cooperative by purchasing inputs and/or marketing agricultural commodities. Input supply and commodity marketing cooperatives in the U.S. were formed to help their producer owners achieve economies of scale and scope, helping mitigate risks in the producers' own operations. These cooperatives return profits to their member owners in

proportion to the amount of business volume conducted by the member. This profit distribution is called patronage and can be returned in a combination of cash and stock.

In the U.S. many agricultural cooperatives are members of larger cooperatives which provide further economies of scale. Under this structure, termed the federal system, farmers are direct members of local cooperatives and the local cooperatives are often a member of one or more larger regional cooperatives. Most local cooperatives started with a single location, but many have grown to multiple locations through internal growth and mergers with other cooperatives. The size, complexity and trade territory of the local cooperative influences its risk exposure. Like the local cooperatives, federated cooperatives distribute patronage to local cooperatives in combination of cash and stock and stock is eventually redeemed under the regional cooperative's equity management system. All of those actions have impacts on the cash flow of the local cooperative and must be considered in simulations and other financial projections.

While there are different variations of cooperative structures most input supply and commodity marketing cooperatives in the U.S. Operate under a structure called open membership cooperative. Under this structure, producers can join at any time. In order to become a voting member and able to receive patronage from the cooperative they must submit a membership application for board approval and purchase a membership share. In most cases membership investment can range from $50-$100 for many grain and farm supply cooperatives. This membership investment is usually set by the board of directors for the individual cooperative. Most of the equity in an open membership cooperatives is created out of the profit stream by distributing a portion of the cooperative's profit in stock.

Overview of Cooperative Finance

The patronage distribution structure creates unique features by which cooperatives can acquire equity capital (Kenkel 2015). There are three primary ways members provide equity to their respective cooperatives which are direct investments, retained margins, and per-unit capital retains. Cooperatives also acquire equity by retained earnings on non-member patronage business.

> *"In the traditional open membership cooperative most of the equity is created by retaining profits. This process is accomplished in three ways: (1) Retaining a portion of patronage refunds and issuing equity shares to members instead of cash patronage, (2) Retaining profits from member business, paying corporate taxes on the profits and retaining the after-tax portion as unallocated reserves (retaining earnings); and (3) Retaining profits from nonmember business, paying corporate taxes on the profits and retaining the after tax portion as unallocated reserves. Profit distribution and retention decisions are at the discretion of the board of directors and impact the cooperative's balance sheet and cash flow as well as the members realized return from the cooperative."* (Kenkel 2015)

CHAPTER III

ENTERPRISE RISK AMANGEMENT

Definition.

All business enterprises are impacted by events which can have negative or positive impact. While in a broad sense the possibility of either negative or positive outcomes can be described as risk, most business managers refer to the possibility of negative outcomes (downside risk) as risk and positive outcomes as opportunities. Business risks can involve anything that decreases the financial performance of the firm or damages its reputation.

Throughout the years businesses have used a variety of techniques to analyze and control risk. These have included identifying insurable hazards and purchasing appropriate levels of insurance, developing internal controls to limit unauthorized actions and protecting against unfavorable price movements through futures market positions and options. In recent years many firms have adopted a more comprehensive approach to identifying and controlling risks, which in referred to as (ERM).

ERM has been defined as:

"*A process, effected by an entity's board of directors, management and other personnel, applied in strategy setting and across the enterprise, designed to identify potential events that may affect the entity, and manage risk to be within its risk appetite, to provide reasonable assurance regarding the achievement of entity objectives"* (Steinberg, et. al., 2004).

ERM is a broad spectrum approach that integrates the concepts of internal controls and strategic planning. ERM involves assessing all of the risks facing an organization and selecting a risk response strategy for the risk identified. A variety of organizations have suggested specific ERM frameworks for classifying and managing risk. The Causality Actuarial Society (2003) suggested classifying risk as:

(1) Hazard risk such as property damage, natural catastrophe and liability torts,

(2) Financial risk such as price risks, asset risk, currency risk and liquidity risk,

(3) Operational risk such as customer satisfaction, product failure, integrity, reputational risk and knowledge drain and

(4) Strategic risks such as competition, social trends and capital availability.

Under ERM the decision makers first identify their risk appetite. An organizations risk appetite can be defined as the amount and types of risks that it is willing to take in order to meet their strategy objectives. Organizations have different risk appetites depending on their sector, culture and objectives (Causality Actuarial Society, 2003). While risk appetite is related to the aggregate amount of risk an organization is willing to take on is inter-related with the concept of "risk capacity" which is a measure of the organization's ability to withstand negative events without seriously jeopardizing its key

goals. After an organization determines its risk appetite, it identifies and quantifies the risks including the interactions and correlations across the identified risks. The final step of ERM is then to respond to the identified risks.

ERM strategies for responding to risks are also described under various frameworks. In general they involve:

(1) Avoidance: exiting the activities that create the risk

(2) Reduction: taking action to reduce the likelihood or impact of the risk

(3) Transfer: insuring or transferring all or a part of the risk to another party

(4) Accept: taking no action to change the risk due a cost/benefit decision

Interpretation and implementation of ERM varies across sectors. In the context of financial institutions ERM has generally focused on quantifying and correlating the risks relating to the portfolio of financial assets and contracts. Financial intuition ERM also often involves a "stress test" or measure of the organization's capacity to withstand risk. In the context of manufacturing firms ERM strategies have often focused on supply chain risks including risks from supply chain partners and third parties. Manufacturing firm ERM also often focuses on the risks associated with innovation including the risks that innovation could make existing products obsolete and the risk that the firm could lose its technological advantage. ERM has not been extensively applied in the context of agribusiness firms or agricultural cooperatives.

Structure of Grain Marketing and Farm Supply Cooperatives

According to USDA statistics there are 2,106 agricultural cooperatives operating in the U.S. with a combined membership of just under two million (USDA, 2016). Agricultural cooperatives serve as an extension of the farm firm providing economies of

scale in purchasing, services and commodity marketing. A defining characteristic of the cooperative business model is that the firm is owned by its users, who share in profits in proportion to their use of the firm. One category of agricultural cooperative which is particularly prevalent in the Central and Midwest U.S. is the grain marketing and farm supply cooperative. As the name implies, these producer owned firms typically purchase, warehouse and apply fertilizer and crop protectants as well as receiving, storing and marketing grain and oilseed crops.

Grain marketing and farm supply cooperatives typically attempt to maintain a predetermined per unit profit margin on both input sales and commodity purchases. For example, a cooperative might strive to sell fertilizer at a $50/ton markup over their purchase price and purchase grains and oilseed crops at $.50/bushel less than they anticipated being able to sell it. Because of this structure of per unit margins, grain and farm supply cooperatives would be expected to be impacted more from by changes in volume than from price changes. Grain and farm supply cooperatives typically purchase fertilizer and other inputs in large lots to warehouse for later sales to producers. They purchase lots of grain periodically from producers and then make bulk sales to regional terminal elevators, exporters or processing firms. Because of that structure and time lag between purchase and sale they can experience changes their actual margins on inputs and commodities may vary relative to their anticipated margin. Competitive pressure from other firms in their trade territory can also impact the margins that they are able to attain.

Grain and farm supply cooperatives, like other firms, have historically used a number of strategies to limit their exposure to risks. They purchase property and casualty

insurance to protect against losses involving their buildings, equipment and vehicles. They implement internal controls to prevent unauthorized actions and establish credit policies to limit the risk of uncollectable accounts receivable. Due to the fact that both grain purchases and grain sales are based on the current daily market price, these cooperatives are exposed to price risk on any volume of grain that they have purchased from the producer and not re-sold up the marketing chain. In recognition of this risk, most grain and farm supply cooperative have established policies limiting the amount of grain that the grain merchandiser can purchase without also purchasing the appropriate futures market contract to offset the market price risk.

As these examples have suggested, grain and farm supply cooperatives have traditionally used a "silo approach" to risk management, maintaining separate strategies to maintain different types of risks. Historically, these firms have not analyzed the aggregate risk facing the cooperative or formally considered their capacity to withstand risk. There are a variety of factors which help explain the lack of a comprehensive strategy towards identifying and controlling risks. Historically, the membership of grain and farm supply cooperatives consisted of relatively small scale producers. This limited the scale of inputs that the cooperative had to purchase and warehouse and meant that most grain was sold in relatively small lots. In addition, many grain marketing and farm supply cooperatives operated in stable trade territories without close competitors. That environment, along with a market environment of relative stable fertilizer and grain prices, allowed them to maintain relatively stable per unit profit margins. In more recent years these cooperatives have a subset of members who operate very large scale farming operations, increasing the volume of inputs warehoused and the scale of transactions. In

addition, price volatility in both input and commodity markets has increased dramatically. The competitiveness of the retail farm supply market price has also increased both due to competition between neighboring cooperatives, competition from investor owned firm and efforts by regional firms to bypass the local retailer and conduct transactions directly with producers. Because of all of these factors, there is need for agricultural cooperatives to take a more comprehensive approach to risk management. Unfortunately, there are a number of impediments to applying the ERM framework to grain and farm supply cooperatives.

Impediments of ERM in Grain Marketing and Farm Supply Cooperatives

There are several possible impediments to an ERM strategy within grain marketing and farm supply cooperatives. Three of these impediments are (1) lack of experience in quantifying risk, (2)lack of instruments to offset or control certain categories of risk, (3) Lack of efforts to systematically investigate the cooperative' capacity to withstand risk and (4) Failure to consider profit distribution and equity management decisions as part of risk management strategies.

(1) Lack of experience in quantifying risk

Cooperative boards of directors and CEOs are familiar with the fact that the cooperative's financial performance varies dramatically across years due to weather, price changes and a wide range of other factors. However, very few of these cooperative leaders have systematically explored the sources of those variations or attempted to quantify or prioritize the risk facing the cooperative.

(2) Lack of risk instruments

Grain and farm supply cooperatives have historically used futures market contracts and other tools to limit the firm's exposure to commodity price risk. Historically, similar tools for controlling the price risk of fertilizer and other inputs have not been available. Additionally, year to year changes in precipitation and other weather factors create large variation in grain volumes and the associated handling and marketing margins. For example, If the growing season was perfect with ideal weather conditions and crop inputs, a 160-acre piece of land in Oklahoma wheat crop with a 65 bu./acre yield would produce 10,400 bushels of wheat. If in that year a bad storm caused some damage making the yield decrease to 20 bu. /acre that farm would only produce 3,200 bushels of wheat. Year to year yield variations of over 70% are not unusual at the producer level. The impact on the entire firm is often someone less dramatic due to the averaging impact across producers but can still be dramatic. In recent years, a limited number of over-the-counter fertilizer price contracts have developed along with derivative contracts based on county level rainfall. These potential instruments to control fertilizer price risk and precipitation risk have not been adopted, partially due to the lack of information on their cost-benefit profile.

(3) Lack of Analysis or Risk Capacity

The board of directors and CEOs of grain marketing and farm supply cooperatives have traditionally managed risks using a silo approach. They have periodically considered separate categories of risk and tried to ascertain that the cooperative had a strategy in place to limit the risk exposure. Historically, they have not attempted to measure the total aggregate risk exposure of the cooperative, quantify or prioritize

individual risk or measured the likelihood of aggregate risks exceeding the firm's financial capacity to withstand them. This has made it difficult for cooperative leaders to analyze new potential risk management instruments or alternative financial strategies which could increase risk capacity.

(4) Failure to Integrate Profit Distribution and Equity Management Decisions into Risk Management Strategies

The decision of how profits will be distributed and retained and the decision on redeeming previously issued revolving equity are key functions of the cooperative board of directors. Both of those decisions have major impacts on the cooperative's cash flow (and thus its ability to sustain risk) and the members' realized return from the cooperative. In theory the board should balance the members' desire for cash patronage and equity redemption payments with the cooperative's need to maintain an adequate cash flow. Ideally, under the principle that the owners are residual claimants, the board should reduce cash patronage levels and delay equity revolving payments when the cooperative experiences risk which severely reduces its cash flow. In practice, many boards do not consider the impact of profit distribution and equity management on the cooperative's risk capacity and attempt to maintain constant profit distribution and equity management programs from year-to-year without regard to the risks experienced.

CHAPTER IV

METHODOLOGY

One of the key steps to implementing ERM is to conduct an analysis to identify and prioritize the organization's critical risks. Our methodology was designed to assist cooperatives with that process by investigating and simulating the total risks faced by typical grain and farm supply cooperatives and then determining the portion of risk attributable to major risk factors. That information would be useful to cooperative leaders as they implemented the concept of enterprise risk management and assessed the major risk factors affecting their cooperative. The research also investigated the impact of changes in profit distribution and equity retirement on the cooperative's risk. That information could help cooperative board of directors understand how they could impact their cooperative's risk capacity through their key decisions on profit distribution and equity management.

Risk Areas

The major risk areas examined included variation in grain volume, grain margin, fertilizer volume, fertilizer margin, and petroleum volume and petroleum margin. Collectively, those activities represent the major revenue stream for grain marketing and farm supply cooperatives. Those activities also involve homogeneous commodities which are more compatible with risk management strategies. The remaining major

revenue streams for the case study cooperatives included the sale of seed and crop protectant chemicals and other miscellaneous income streams such as car washes, seed cleaning and trucking. On the audited financial statements, income from those activities is commonly classified as "Other Farm Supply Margins." Seed and crop protectant sales involve a diverse product line with substantial variation in profit margin across products. The risks associated with those products and other miscellaneous revenue was not specifically investigated.

Simulation Model and Data

A six-year time series of financial and operating data was acquired from 10 Oklahoma grain marketing and farm supply cooperatives. Included in the data were physical units of grain, fertilizer, petroleum, and the profit margin for each commodity. The historical data was used to estimate normally distributed random variables for grain volume, grain margin, fertilizer volume, fertilizer margin, petroleum volume and petroleum margin. Some other revenue generating activities such as grain storage income, fertilizer application revenue and patronage from regional cooperatives were linked to the random variables and were thus also indirectly stochastic.

A cooperative financial simulation program developed at Oklahoma State University was used to develop a 30 year simulation for the case study cooperatives (Kenkel and Holcomb, 2005). The simulations modeled the sales, expenses, profits and profit distributions of the firm and considered the cash flow required for infrastructure reinvestment and equity retirement. Profit distribution (cash and retained equity) were based on the historic practices of each cooperative. Equity revolvement (redeeming previously issued equity patronage into cash) was based on the equity profile and equity

management system (age of stock or age of patron) used by each cooperative. Patronage from regional cooperatives was projected from the historic relationship with farm supply sales with the split between cash and stock regional patronage based on historic averages. The cash portion of regional patronage is included in the projected profits and cash flows. No attempt was made to model redemption of regional patronage since several regional cooperatives are moving to base capital and/or permanent equity models.

Fixed expense categories such as depreciation, maintenance and repairs, insurance and property tax were modeled based on their historic relationship with fixed asset levels. Personnel expense was based on the most recent fiscal year. Residual expenses (expenses not represented by those categories) were projected at their historical average value. Inventory and accounts receivable levels were modeled based on their historic relationship with farm supply sales. Additional investment in fixed assets was modeled at a constant 5% growth rate. This figure is a conservative approach as compared to the historic growth rate in fixed assets which averaged 12.1% for the case study cooperatives. The firm specific growth rates are not used because many of the case study cooperatives had replaced major assets such as grain bins or fertilizer warehouses during the previous six years. It therefore seemed likely that their long term asset growth will be lower than their recent historical average. The five percent fixed asset investment was roughly equivalent to the depreciation expense for most of the case study firms.

Profiles of equity by age of patron or age of stock (as appropriate) were obtained for each cooperative. Five of the ten case study cooperatives used an age of patron equity retirement system while the remainder used an age of stock system. Equity retirement triggers ranged from 18-20 years for age of stock plans and from age 65 to age 70 for age

of patron plans. The baseline profit distribution of cash patronage, retained qualified equity, and retained unallocated equity were based on historical patterns. In cases where the cash patronage rates were not constant over the six year period of historic data, phone interviews with the CEOs were conducted to determine the most typical profit distribution. The percentage of nonmember business (which is not provided in the audited financial statements) was also obtained from the CEO interviews. An effective tax rate of 9.4% was used for the cooperatives based on research by Russell and Briggeman (2014).

The 10 Oklahoma cooperatives had an average of $12,875,703 in total assets, $7,872,893 in total equity with an average unallocated to total equity ratio of 57 percent. On average they had $2,552,687 in total working capital (current assets minus current liabilities). Total sales averaged $24,195,153 and 83.4 percent of sales were from member business. As mentioned, the cooperatives had an average annual growth rate of total fixed assets of 12.1 percent. Exactly half of the cooperatives were on an age of patronage equity redemption system with an average age trigger of 67 years and while the other five were on an age of stock equity redemption system with an average revolving period of 20 years.

Nine of the case study cooperatives distributed profits in a combination of cash and qualified stock, with the cash portion ranging from 21% to 50%. One cooperative distributed a combination of cash and nonqualified stock with a 15% cash portion. None of the case study cooperatives retained member profits in the form on unallocated equity but they all retained the after tax portion of nonmember profits as unallocated equity. Each cooperative's historic system for profit distribution and equity retirement was used

in all of the simulated scenarios except the final scenarios where changes in cash patronage and equity revolving periods were specifically examined.

Simulation Procedures

For each scenario a 30 year time series of pro-forma financial statements was created for each cooperative. Various measures of risk were calculated for the 30 year projection periods. Those measures included the standard deviation of cash flows, the minimum cash flow during the 30 year period and the frequency of a negative cash flow occurring during the projection period. The simulations were repeated 500 times representing 15,000 years of projected financial results and the financial results were averaged over all of the simulations.

In all, nine scenarios were investigated. The first scenario was the baseline scenario with the volumes and margins for grain, fertilizer and petroleum represented by random draws from the respective distribution and profit distribution and equity management set at each cooperative's historical baseline. The risk attributable to each risk factor (example: grain volume) was estimated by replacing the random variable for that risk factor with the average of the distribution and determining the change in the risk measures. For example, the first case study cooperative could reduce cash flow standard deviation by 10% if they eliminated all variation in grain volume and by 8.5% if they were able to eliminate variation in grain margins.

In addition to the baseline scenario and six scenarios investigating risk factors, two additional scenarios investigated the impact of profit distribution and equity management decisions. In the first scenario all risk factors were allowed to vary but the percentage of the total member based profits distributed as cash patronage was increased

by 10%. For example, if the cooperative was distributing profits as 40% cash and 60% qualified stock, the profit distribution was changed to 50% cash and 50% qualified stock. Increasing cash patronage reduces a cooperative's cash flow and would be expected to increase the occurrence of negative cash flows. The final scenario was similar except that the profit distribution was returned to the respective baselines but the equity revolving period was reduced by 5 years. For example, if the cooperative retired equity based on patron age 70, that trigger age was reduced to age 65. Similarly, if the cooperative retired equity based on age of stock with a trigger stock age of 20 years, the trigger stock age was reduced to 15 years. Accelerating the equity revolving cycle increases the member's return but also reduces cash flow and would also be expected to increase the occurrence of negative cash flows.

CHAPTER V

RESULTS

A summary of the financial data from the case study cooperatives that was used in the simulation is provided in Table 1. The cooperatives varied in size from 850,000 bushels of grain sales to almost 42 million bushels. All of the cooperatives had activities in marketing grain, and providing fertilizer and petroleum. The relative importance of those activities in terms of sales margins generated varied widely across the cooperatives. All but one cooperative applied fertilizer. Because the cooperative used different audit firms there not perfect consistency across the minor categories. For example, the reports on two cooperatives did not separate sales and margins for "other farm supply" items but instead presumable included those margins in other income. Similarly, many of the financial statements did not separate membership stock, which is typically not revolving equity, from common stock which is typically revolving equity created through retained patronage. Membership stock is typically a very small percentage of allocated equity so the impact on projecting equity revolving cash flows was minimal.

In terms of the simulating risk, the key data was the standard deviations in volume and margins for the marketing and input commodities. As the table indicates, those standard deviations varied widely across cooperatives. For example, the standard deviation of grain volume, as a percentage of the mean ranged from 14.5% to 46.4%

while the standard deviation in grain margin ranged from 25.1% to 64.4%. On average, grain margins had the highest variation followed by grain volume, petroleum volume, fertilizer margin, fertilizer volume and petroleum volume. The level of variation in margin or volume should not be interpreted as a measure of the relative risk of the activities since additional income streams such as fertilizer application and grain storage were associated with commodity volumes and the commodity areas made up different proportions of overall income. It was also interesting to note that patronage from regional cooperatives, as a percent of farm supply sales, varied substantially across the cooperatives. That likely reflected the differences in product mixes and differences in involvement with specific regional cooperatives.

Table 1: Financial Data for Case Study Cooperatives Used in Simulation Model

Cooperative	A	B	C	D	E
Grain volume	2,296,673	1,648,261	2,486,990	849,597	1,523,778
grain volume std/mean	19.0%	30.2%	46.4%	42.2%	14.5%
grain margin	$ 0.48	$0.27	$0.48	$ 0.29	$0.61
Grain margin std/mean	25.6%	39.4%	23.9%	42.0%	30.0%
Fertilizer volume	7,069	5,137	5,017	3,315	10,026
fertilizer volume std/mean	15.4%	14.0%	9.4%	16.6%	10.3%
fertilizer margin	$ 63.2	$123.00	$73.84	$133.39	$55.54
fertilizer margin std/mean	20.0%	20.0%	16.5%	36.5%	18.7%
Petroleum volume	1,820,166	1,402,350	1,605,819	442,259	810,260
Petroleum volume std/mean	55.2%	40.8%	44.7%	13.6%	9.4%
Petroleum margin	$0.21	$0.25	$0.20	$0.17	$0.20
Petroleum margin std/mean	4.9%	1.2%	4.3%	4.0%	4.2%
Other Farm Supply sales	$ 3,536,198	$448,657	$0	$ 0	$2,499,985
Other farm supply % margin	25.8%	25.8%			15.7%
Grain storage per bushel	$0.20	$0.20	$ 0.23	$ 0.18	$0.14
Grain storage std dev	$ 0.04	$ 0.06	$ 0.11	$ 0.08	$ 0.02
Fertilizer application per ton	$55.3	$0	$76.2	$56.0	$38.4
Other Income	$335,617	$278,239	$266,605	$90,000	$716,451
Reg. cash pat/supply margin	22.3%	18.1%	22.3%	11.5%	7.2%
Reg. stock pat/supply margin	21.7%	14.4%	21.7%	19.8%	6.0%
Personnel Expense	$1,617,712	$733,008	$990,991	$473,918	$ 938,192
Maintenance/Fixed assets	9.8%	3.7%	27.7%	0.0%	0.7%
Depreciation/Fixed assets	16.7%	5.0%	13.9%	16.8%	4.2%
Insurance/Fixed assets	6.0%	7.5%	5.9%	0.0%	2.4%
Prop Tax/Fixed assets	2.0%	2.0%	2.0%	7.2%	0.5%
Fixed assets	$1,560,159	$1,316,920	$243,820	$662,579	$6,395,703
Accounts Rec./Agron. Sales	6.4%	5.6%	2.5%	6.8%	7.3%
Inv. to Agronomy Sales	15.0%	6.0%	12.0%	11.0%	75.0%
Other Income	$20,000	$18,003	$0 -	$32,214	$0
Membership stock	$96,800	$0	$0	$0	$0
Qualified stock	$1,257,044	$1,017,475	$1,795,697	$1,223,689	$645,587
Non Qualified stock	$ 0	$ 0	$0	$0	$0
Unallocated equity	$ 2,769,317	$3,239,131	$2,769,317	$ 819,117	$ 1,876,496
Debt/asset	15.9%	1.1%	9.1%	4.0%	3.9%

Table 1: Financial Data for Case Study Cooperatives Used in Simulation Model-Continued

Cooperative	F	G	H	I	J	Average
Grain volume	2,558,901	4,101,373	41,833,341	2,949,937	1,145,961	6,139,481
grain vol std/mean	26.2%	23.8%	19.5%	51.2%	37.2%	31.0%
grain margin	$0.22	$ 0.49	$ 0.15	$0.28	$0.78	$ 0.41
Grain mar std/mean	25.1%	25.8%	37.9%	49.5%	64.4%	36.4%
Fertilizer volume	14,586	11,381	38,212	8,917	10,149	11,381
Fert. Vol. std/mean	18.5%	14.0%	11.1%	36.5%	24.5%	17.0%
fertilizer margin	$67.30	$63.25	$81.43	$59.74	$60.00	$78.07
Fert. mar std/mean	15.8%	20.0%	26.3%	18.9%	45.3%	23.8%
Petroleum volume	1,820,166	2,149,000	9,798,216	310,753	1,334,743	2,149,373
Petro. vol. std/mean	20.6%	0.1%	21.7%	65.4%	29.0%	30.0%
Petroleum margin	$0.20	$0.21	$0.18	$0.17	$0.13	$0.19
Petro. mar std/mean	5.3%	1.0%	4.5%	3.4%	6.0%	3.9%
Other farm Sup sales	$5,527,789	$7,753,268	$2,166,406	$2,713,011	$1,910,165	$2,655,548
Other farm supply % mar.	16.0%	9.5%	14.8%	13.0%	13.7%	18.6%
Grain storage/ bul	$0.19	$0.20	$0.01	$0.20	$0.19	$0.17
Grain stor std dev	$0.05	$0.05	$0.00	$0.10	$0.07	$0.06
Fertilizer app. /ton	$27.5	$0	$23.4	$14.6	$77.8	$36.9
Other Income	$2,078,668	$817,463	$1,777,368	$1,288,504	$1,913,927	$956,284
Reg. cash pat/supply mar.	7.7%	33.8%	18.0%	10.7%	13.8%	16.5%
Reg. stock pat/supply mar.	11.7%	35.7%	27.0%	5.8%	19.5%	18.3%
Personnel Expense	$2,113,813	$1,239,713	$4,738,000	$1,185,442	$1,922,041	$1,598,283
Main./Fixed assets	8.0%	6.0%	15.6%	5.9%	0.8%	7.8%
Dep.Fixed assets	19.6%	14.4%	11.4%	12.1%	3.5%	11.8%
Ins./Fixed assets	5.9%	0.0%	5.2%	14.9%	1.9%	5.0%
Prop Tax/Fixed assets	1.66%	0.0%	1.8%	4.0%	0.4%	2.2%
Fixed assets	$3,160,341	$2,000,900	$6,323,641	$1,295,495	$14,136,021	$3,709,558
Acc. Rec./Agr Sales	6.1%	10.5%	5.5%	13.9%	10.3%	7.5%
Inv. to Agr.. Sales	15.0%	47.0%	9.0%	17.0%	27.0%	23.4%
Other Income	$7,629	$0	$761,463	$29,085	$58,883	$103,031
Membership stock	$0	$0	$0	$0	$0	$13,829
Qualified stock	$2,679,627	$2,151,452	$7,643,772	$931,394	$2,566,926	$2,191,266
Non Qualified stock	$ 0	$0	$0	$0	$0	$0
Unallocated equity	$4,312,885	$2,014,587	$9,706,274	$2,088,732	$2,225,249	$3,182,111
Debt/asset	5.3%	10.5%	2.1%	10.9%	15.0%	7.8%

A summary of the average annual cash flow, the minimum annual cash flow observed over the 6 year historical period and the average annual cash patronage and equity revolving payments are provided in Table 2 below. Annual cash flow averaged $117,332 over all of the case study firms. Three cooperatives averaged negative cash flows during the historical data period indicating they reduced their overall cash balances. Only one of the case study firms did not experience a year with a negative cash flow during the six years of historical data. Cash patronage payments averaged $307,271 across all firms while payments to revolve previously issued equity averaged $122,136. Annual cash patronage payments averaged 3.6 times annual cash flow while equity payments average 2.6 times annual cash flow. Across the 6 years of data for the 10 cooperatives there were 16 occurrences of negative cash flows. The respective cooperative paid cash patronage in 14 of those 16 years and retired equity in all 16 of those years. Taken together those results suggests that profit distribution and equity management decisions could have substantial impact on occurrence of negative cash flows but those decisions do not appear to be used as tools to stabilize cash flows.

Table 2: Historical Cash Flow, Cash Patronage & Equity Revolving Payments

Coop	Average Annual Cash Flow	Minimum Cash Flow	Average Cash Patronage	Average Equity Revolve
A	$ (16,878)	$ (193,307)	$ 119,490	$ 78,124
B	$ 92,922	$ (753,578)	$ 271,406	$ 64,024
C	$ 118,232	$ (409,617)	$ 306,382	$ 121,236
D	$ 14,330	$ (121,096)	$ 262,928	$ 200,390
E	$ 111,526	$ 104,466	$ 97,145	$ 81,804
F	$ 677,132	$ (639,183)	$ 253,082	$ 81,804
G	$ 8,398	$ (3,746)	$ 115,075	$ 106,653
H	$ 305,543	$ (1,470,506)	$ 1,526,690	$ 448,595
I	$ (48,057)	$ (229,721)	$ 7,329	$ 7,177
J	$ (89,827)	$ (469,879)	$ 58,990	$ 31,550
Average	$ 117,332	$ (418,617)	$ 307,271	$ 122,136

The relative importance of the various business areas varied substantially across cooperatives (Table 3). Margins from storing and marketing grain accounted for 73% of the total margins for Cooperative G and only 28% of total margins for Cooperative B. Margins from supplying and applying fertilizer (which was classified as "Agronomy") ranged from 0% to 58% of total margins. It should be noted that the inconsistencies in the format of the audited financial statements made it difficult to separate fertilizer related margins from the "Other Farm Supply" category. The importance of the "Other Farm Supply" department ranged from 0% to 32% of total margin. One of the case study cooperatives operated a retail hardware store and another operated a retail home and garden store. The cooperatives also varied in their emphasis on providing seed and crop protection chemicals. Petroleum related activities did not represent the largest source of gross margin for any of the case study cooperatives but did account for over 15% of total margins for three of the ten case study firms.

Table 3: Department Margin Percentage of Total Gross Margin by Cooperative

Coop	Grain	Petroleum	Agronomy/Fertilizer	Other Farm supply
A	38.76%	13.44%	15.72%	32.09%
B	28.84%	22.72%	40.94%	7.50%
C	63.32%	17.03%	19.65%	0.00%
D	32.26%	9.84%	57.90%	0.00%
E	45.56%	7.94%	27.29%	19.20%
F	20.16%	13.04%	35.16%	31.64%
G	73.18%	0.00%	0.002%	26.82%
H	54.71%	15.38%	27.13%	2.79%
I	46.82%	2.99%	30.20%	19.99%
J	46.11%	8.95%	31.41%	13.53%

The average correlation coefficients between the commodities comprising the risk factors are provided in Table 4. The volumes of grain, fertilizer and petroleum were mildly correlated suggesting that when weather, or other events decrease grain volume producers also reduce fertilizer and petroleum purchases. Some of that correlation was likely due to the fact that the cooperatives were, in general, increasing handling volumes of all commodities over the time period of the historical data. The correlations between commodity volumes implies that the total risk facing the case study cooperatives could be slightly higher than our model indicated since the volume risks in one commodity had a positive association with the volume risk of another commodity.

The correlations between volume and margin for grain and fertilizer were negative and small in magnitude. That implies that when factors caused the cooperative's volumes of those commodities to decline the cooperative was able, to a small extent, to increase margins. In that regard our model may overstate risk since the margin movements serve to slightly offset the impact of reduced volumes. The correlation between petroleum volume and margin was very small in magnitude (.04) and positive, suggesting that cooperatives are forced to slightly lower their fuel margins when their fuel volumes decline. Because of the fact that all of the correlations were small, and were based on a limited time series (6 years) of historical data, our model did not consider correlations between commodity volumes or commodity prices and volumes and modeled all of those factors as independent variables.

Table 4: Average Correlation Between Commodities and Between Commodity Volumes and Margins

Grain volume/fertilizer volume	0.13
Grain volume/petroleum Volume	0.15
Fertilizer volume/petroleum volume	0.16
Grain volume/grain margin	-0.09
Fertilizer volume/fertilizer margin	-0.11
Petroleum volume/Petroleum margin	0.04

Baseline Results

The baseline scenario, averaged across the 10 case study cooperatives is provided in Table 5. On average the standard deviation of cash flows was 53% of average cash flow. If the cash flow variation were distributed normally that would imply that there was a 32% probability that the cooperatives cash flow could be reduced by 53% and a 5% probability that it could be reduced by 106%, implying a negative cash flow. That was consistent with the frequency of occurrences of negative cash flows in the simulations which average 1.63 times or in around 5% of the 30 year projected period for each cooperative. It should be noted that the occurrence of negative cash flows in the simulation models (approximately 5%) was lower than the occurrence of negative cash flows from the audited financial statements (approximately 25%). The primary reason was that the simulation model did not consider variation in income from other farm supply sales, miscellaneous income categories or variation in the cash patronage rates of regional cooperatives.

On average, the member's IRR was 15.91%. The member IRR would not be expected to be impacted by the various risk scenarios since those scenarios involved

replacing normally distributed random variables for price and volume with the mean of distribution. The member IRR would be expected to be impacted by changes in cash patronage and the equity revolving period. Those decisions also impact the cooperative's cash flows and the risk of negative cash flows.

Table 5: Baseline Results

	Average	Range
Average Cash Flow	$1,598,263	$485,484 to $6,107,384
Cash flow standard deviation	$843,047	$296,752 to $2,618,983
Minimum cash during projection period	$89,399	-$524,791 to $1,324,839
Number of years of negative cash flow in projection period	1.63	0 to 5.6
Member Internal Rate of Return	15.91%	Negative to 27.5%

Results from Risk Scenarios

The impact of the six risk reducing scenarios and the two financial management scenarios are provided in Table 6. As expected, the six scenarios which eliminated particular risk components did not impact the average cash flow of the cooperative or the members IRR. Increasing the percent of cash patronage substantially decreased the cooperatives cash flow and increased the member's IRR. Accelerating the equity revolving period also reduced the average cash flow and increased the member's IRR but the impact was less drastic.

Grain volume was the largest risk factor for the case study cooperatives. On average, the cooperatives could have reduced the standard deviation of their cash flows by 20.33% and reduced the occurrence of negative cash flows by 39.23% if they could eliminate that risk factor. Grain volume, which is largely due to weather and production

risk, would be expected to be a major risk factor. Grain handling involves a large portion of fixed costs, so the residual profits and cash flows would be expected to be heavily dependent on volume. On average, grain margin was the second largest source of risk accounting for 12.89% of the cash flow standard deviation and 24.62% of the occurrence of negative cash flows. Grain and farm supply cooperatives attempt to maintain a fixed per-unit margin in their grain handling operations so the relevant importance of grain margin risk is somewhat surprising. When a cooperative purchases grain from a producer they generally either immediately sell it up the supply chain (back to back) or have a sales price protected via a forward contract position. Their realized grain margin can still vary due to changes in the basis, inaccuracy of grading and changes in transportation rates. Competitive pressures can also influence grain margin when a cooperative reduces margins in an attempt to attract bushels. Grain quality loss due to insects and other factors can also reduce grain margins but is generally not a significant factor in well managed elevators.

The next most important risk factor was variation in fertilizer margin which, on average, accounted for 5.84% of cash flow variation and 18.57% of instances of negative cash flows. Grain marketing and farm supply cooperatives also attempt to maintain a constant per unit (per ton) profit margin in fertilizer. However they purchase and inventory a substantial portion of their volume prior to the application seasons. Variation in fertilizer prices can impact their margins because, unlike grain where the producers have already delivered to the elevator, producers have access to alternative suppliers. If fertilizer prices fall after a cooperative purchases and inventories fertilizer they may be forced to reduce their margin to meet the price of a competitor who is purchasing

inventory on a "hand to mouth" basis. Conversely, if prices rise the cooperative may be able to increase margins if the competition did not have the foresight to preposition inventory. Fertilizer volume was the next major risk factor representing 2.92% of cash flow standard deviation and 6.87% of the risk of negative cash flows. The volume of fertilizer demanded is impacted by weather, and to a lesser extend commodity prices. However, because fertilizer is applied at planting and in the middle of the growing season, year to year usage is more constant than grain volume.

Variation in the volume of petroleum products sold and the profit margin on those products was not, on average, a major source or risk for the case study cooperatives. That reflects the fact, that while there was significant year to year variation in petroleum volumes and margins, that activity represented a modest portion of overall margins for the case study cooperatives.

Table 6: Impact of Various Risk Components or Management Practice on Cash Flow and Member IRR

	Change Average cash flow	Change Cash Flow Std	Change in Number of Negative Cash flow	Change Member IRR
Grain Vol,	0.39%	-20.33%	-39.23%	-0.53%
Grain Mar.	0.05%	-12.89%	-24.62%	-0.27%
Fertilizer Vol	-0.05%	-2.92%	-6.87%	-0.17%
Fertilizer Mar.	0.16%	-5.84%	-18.57%	-0.45%
Petro Vol.	-0.04%	-0.02%	1.07%	-0.01%
Petro Mar.	-0.37%	-0.68%	-4.08%	-0.39%
Increase Cash	-14.85%	-13.22%	1.15`%	47.30%
Accelerate Revolve	-1.22%	0.96%	7.02%	4.30%

The change in risk, as measured by change in the standard deviations in cash flow, with each risk factor or management change is shown for each case study cooperative in Table 7. The relative importance of each risk component varied

considerably across the case study cooperatives. For example, grain volume accounted for 2.2% of cash flow standard deviations for Cooperative E and 53.2% for Cooperative C. As the previous results from Table 3 indicated, grain margins represented a substantial portion of total margins for those cooperatives. In addition, the results likely reflected the difference in weather patterns impacting the cooperatives. Some of the case study cooperatives were in Southwest Oklahoma which is typically more susceptible to drought relative to the North Central and Central regions of the state. For all of the cooperatives the major risk factor was either grain volume, grain margin or fertilizer margin. Fertilizer margin appeared to be a more important source of risk for cooperatives D and B. Fertilizer margins represented a much higher portion of total margins for those cooperatives relative to the other firms. In addition, the results could reflect differences in the percent of their volume that they are able to purchase prior to application season and warehouse, and/or competitive pressures from other suppliers.

Table 7: Change in Cash Flow Standard from Risk Component or Management Strategy by Cooperative

Coop	Grain Volume	Grain Margin	Fert. Volume	Fert. Margin	Petrol. Volume	Petrol. Margin	Increase Cash	Accel. Revolve
A	-10.1%	-8.5%	-2.5%	-2.4%	-0.2%	-2.3%	-8.5%	4.0%
B	-24.1%	-12.9%	-5.3%	-11.5%	-1.2%	-1.3%	-13.4%	0.2%
C	-53.2%	-5.1%	-1.3%	-0.2%	-1.3%	-1.5%	-24.0%	1.1%
D	-14.1%	-5.1%	-5.5%	-22.8%	0.5%	0.8%	-13.1%	1.3%
E	-9.2%	-21.7%	-2.4%	-4.1%	-0.6%	0.0%	-18.3%	-0.8%
F	-2.2%	0.3%	-2.5%	-0.7%	0.8%	0.8%	-8.0%	3.0%
G	-28.0%	-14.9%	1.4%	0.2%	1.3%	0.4%	-10.3%	0.4%
H	-9.8%	-31.8%	-1.3%	-7.7%	-0.1%	-2.9%	-13.2%	0.8%
I	-45.3%	-13.2%	-5.6%	-2.8%	-1.3%	-1.5%	-9.9%	-1.5%
J	-7.4%	-16.0%	-4.2%	-6.2%	1.9%	0.9%	-13.4%	1.2%
Avg	-20.3%	-12.9%	-2.9%	-5.8%	0.0%	-0.7%	-13.2%	1.0%

The change in the occurrence of negative cash flows from risk components and management strategy is provided in Table 8. This risk measures illustrates the impact of cooperative's ability to sustain risk. It should be recalled that the average occurrence of negative cash flows, averaged across all cooperatives, was 1.63 over the 30 year projection period. The changes in negative cash flow occurrence, while sometimes significant on a percentage basis were relatively small. Two of the case study cooperatives did not experience negative cash flows under the baseline (all risk components) scenario and eliminating the risk components obviously made no reduction in the negative cash flow occurrence. In terms of risk components, grain volume had the largest impact on negative cash flow occurrence followed by grain margin and fertilizer margin. Eliminating variation in grain volume would have eliminated all of the occurrences of negative cash flows for Cooperative B and 94% of the occurrences for Cooperative G.

On average, accelerating the revolving period increased the occurrence of negative cash flows by 7%. That indicated that equity management had a relatively small impact of negative cash flow occurrence. It should be noted that most of the case study cooperatives had relatively long revolving period so the one-year acceleration was a relatively small change. On average, increasing the percentage of profits distributed as cash patronage by 5% increased the occurrence of negative cash flows by 1.1%. The effect of profit distribution was somewhat complex. Increasing the percentage of cash patronage implied a lower percentage of revolving stock patronage. In the case of the cooperatives with shorter revolving periods the lower cash flows for equity revolving in the later years of the simulation sometimes reduced the occurrence of negative cash flows

in those years. That led to somewhat ambiguous results as the impact of cash patronage on negative cash flow occurrence. In actual cooperatives, the board of directors would likely adjust cash patronage in a year where a negative cash flow was imminent, so the simulation strategy of a permanent change in profit allocation was not entirely realistic.

Table 8: Change in Occurrence of Negative Cash Flows from Risk Component or Management Strategy by Cooperative

Coop	Grain Volume	Grain Margin	Fertilizer Volume	Fertilizer Margin	Petroleum Volume	Petroleum Margin	Increase Cash	Accel. Revolve
A	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
B	-59.2%	-22.4%	-3.9%	-28.4%	3.3%	3.5%	-2.6%	5.1%
C	-100.0%	0.2%	-5.0%	-6.8%	4.6%	-12.6%	-3.8%	37.7%
D	-44.5%	-12.9%	-16.2%	-74.4%	2.2%	1.6%	-1.6%	8.6%
E	-14.1%	-29.9%	-1.6%	-3.7%	2.1%	-3.0%	11.1%	-2.8%
F	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
G	-94.0%	-51.7%	-0.7%	2.6%	0.7%	-1.5%	-1.1%	2.6%
H	0.0%	-100.0%	-23.5%	-64.7%	-2.9%	-29.4%	0.0%	17.6%
I	-78.0%	-18.1%	-11.7%	-6.2%	-0.8%	-0.4%	-4.7%	1.7%
J	-2.5%	-11.4%	-6.0%	-4.1%	1.6%	1.0%	14.2%	-0.3%
Avg.	-39.2%	-24.6%	-6.9%	-18.6%	1.1%	-4.1%	1.1%	7.0%

The change in the members' IRR from the cooperative from changes in profit distribution and equity revolving cycle is summarized in Table 9. Cooperative H was indicated to have a negative member IRR at baseline and after the changes in cash patronage and equity revolving cycle. It was therefore not possible to determine the impact on member IRR from the cash patronage or revolving cycle change for that cooperative. Increasing the percentage of profits distributed as cash patronage had a relatively dramatic positive impact on the member's IRR. It is interesting to note that the cooperatives which demonstrated the largest impact (Cooperatives A, E and J, also experienced large increases in cash flow standard deviation and negative cash flow occurrence from the cash patronage increase. Accelerating the equity revolving period

also increased member IRR but the results were less dramatic. Taken together, the results highlight the temptation of cooperative boards of directors (who are elected from the membership) to maximize cash patronage and accelerate equity retirement. The previous results have shown the resulting impact on the risk capacity of the cooperative.

Table 9: Change in Member IRR Due to Change in Cash Patronage or Equity Revolving Cycle.

Coop	Increasing Cash Patronage	Accelerating Revolving Cycle
A	…41.65%	18.31%
B	32.51%	0.01%
C	24.51%	10.92%
D	49.81%	2.73%
E	61.98%	0.20%
F	57.19%	11.81%
G	NA	NA
H	49.97%	22.81
I	39.15%	-1.36%
J	77.76%	-0.01%
Average	47.30%	7.16%

CHAPTER VI

IMPLICATIONS AND AREAS FOR FURTHER RESEARCH

This simulation based research, which was based on financial and operating data from ten grain marketing and farm supply cooperatives, demonstrates how the principles of ERM could help cooperatives leaders analyze and manage risks. The research identified some major risk areas for grain and farm supply cooperatives which included grain volume, grain margin and fertilizer margins. Variation in fertilizer volume, petroleum volume and petroleum margin were shown to be less significant sources of risk. The implication of those results is that grain and farm supply cooperatives could benefit from using a comprehensive approach to evaluating risk across their marketing and supply activities.

The results indicated positive but relative small correlations between grain volume, fertilizer volume and petroleum volumes. Those correlations suggest that volume risks are interrelated across commodities. The results also indicated negative and small magnitude correlations between price and volume variation within the commodities. That suggests that grain marketing and farm supply cooperatives have little opportunity to offset lower volumes with higher margins. This research did not attempt to model correlations in volumes across commodities or any interaction between volume and price variation. Due to the small magnitude of those correlations, those

relations likely had a small impact on overall risk. A more complex simulation model which fully incorporated correlations across risk areas and between prices and volumes could be a topic of further research.

An important contribution of the research was the observation that the relative risk areas varied fairly dramatically across the case study firms. While variation in grain margin had the largest risk impact on average, variation in grain margin was the most significant risk factor for one cooperative and fertilizer margin was the leading risk area for another of the case study firms. That result suggests that risk management strategies for grain marketing and farm supply cooperatives are not a "one size fits all" situation but instead, must be tailored to each cooperative.

In this research, two measures of risk were considered: cash flow standard deviation and occurrence of negative cash flows. Results on other measures such as average cash flow and minimum cash flow were calculated and are presented in the Appendix. In general, all of the risk measures led to similar conclusions as to the relative importance of the risk areas across the case study cooperatives. The baseline results illustrated a relative low probability of negative cash flow occurring (1.63 times out of 30 years, on average). Cooperative boards of directors are likely concerned with less extreme thresholds such as maintaining a specified amount of cash or working capital as specified by their lender in the loan covenants. The negative cash flow occurrence measure did emphasize the fact that some risk areas, such as petroleum volume and margins, are often not large enough to impact the cooperative's overall risk position.

As in many studies, this research has also highlighted additional questions which present opportunities for further research. While grain volume was indicated to be a

significant risk measure, this research did not investigate whether the mix of summer crops and winter crops affected grain volume variability. While a cooperative could not impact its member's cropping decisions, identifying any relationship between cropping mix and grain volume variability might allow the cooperative to anticipate changes in grain volume risk exposure.

A cooperative's grain margin, which was also a major source of risk, is impacted by numerous factors including accuracy in grain grading, merchandising strategies, grain shrinkage and transportation costs. Additional research could be conducted to better understand the underlying causes of variation of grain margins across marketing years. That information would be useful to cooperatives that were designing strategies to mitigate grain margin risk. There are also a similar number of factors which could lead to difference in fertilizer margins including differences in purchasing strategies (when to purchase and inventory fertilizer), warehouse size, shrinkage, discounts for advances purchase, volume or cash payment and transportation costs. As in the case of grain margins, further research could be conducted to better understand the underlying causes of fertilizer margin risk which would improve the design of strategies to mitigate those risks.

These results highlighted the fact that board and management decisions such as the cash patronage percentage and the equity revolving period can have a large impact on both the cooperative's risk capacity and the member's return. This research investigated the impact of a constant change in those variables which was maintained for the entire projection period. Cooperative boards of directors could also adjust cash patronage and/or equity revolving strategies on a year-to-year basis in response to risk or cash flow

triggers. Modeling and investigating the impact of those strategies would be a worthy area for future research.

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APPENDICES

Table A1: Baseline Results by Cooperative

Coop	Average Cash Flow	Cash flow Standard Deviation	Minimum cash during projected period	Number of years negative cash flow in projection period	Member IRR
A	$1,589,841	$547,476	$425,176	0.0	19.2%
B	$485,484	$306,284	$24,638	1.3	15.2%
C	$714,550	$490,863	($377,499)	1.3	24.7%
D	$394,331	$269,752	($322,226)	1.5	6.7%
E	$455,262	$359,065	$44,667	3.2	27.5%
F	$2,697,547	$988,330	$810,675	0.0	9.0%
G	$2,011,233	$1,157,916	($518,333)	0.5	-
H	$6,107,384	$2,618,983	$1,324,839	0.1	13.3%
I	$894,604	$826,663	($524,701)	2.8	19.1%
J	$632,295	$865,137	$6,755	5.6	8.5%

Table A2: Actual Change from Baseline in Average Cash by Cooperative

Coop	Grain Volume	Grain Margin	Fertilizer Volume	Fertilizer Margin	Petroleum Volume	Petroleum Margin
A	$175	$5,134	$2,003	$276	($3,280)	($6,983)
B	($812)	($2,345)	($4,339)	($1,956)	($501)	($2,448)
C	($1,642)	($7,849)	($12,047)	($5,238)	($14,693)	($5,727)
D	$6,208	$4,381	$6,471	$8,085	$4,814	$470
E	$1,156	$1,427	$10	$1,520	($820)	$2,014
F	$1,667	($2,697)	($511)	($2,368)	$3,274	$2,480
G	$13,185	$8,739	$9,192	$5,638	$16,741	$8,934
H	($11,282)	($6,733)	$45,732	($5,848)	$18,982	($18,273)
I	$24,393	($2,080)	($5,241)	$302	($6,895)	($3,284)
J	($4,919)	$2,026	($2,142)	$1,432	$3,008	($14,807)
Average	$2,813	$0	$3,913	$184	$2,063	($3,762)

Table A3: Actual Change from Baseline in Cash Flow Standard Deviation by Cooperative

Coop	Grain Volume	Grain Margin	Fertilizer Volume	Fertilizer Margin	Petroleum Volume	Petroleum Margin
A	($55,150)	($46,756)	($13,555)	($13,039)	($969)	($12,453)
B	($73,662)	($39,644)	($16,190)	($35,370)	($3,794)	($4,029)
C	($260,931)	($24,866)	($6,387)	($779)	($6,174)	($7,524)
D	($38,006)	($13,671)	($14,924)	($61,614)	$1,434	$2,045
E	($32,906)	($77,892)	($8,713)	($14,627)	($2,272)	($117)
F	($21,866)	$3,157	($24,427)	($7,155)	$7,566	$7,608
G	($323,802)	($172,706)	$16,167	$1,876	$15,106	$4,403
H	($257,209)	($831,708)	($34,148)	($202,013)	($1,769)	($76,986)
I	($374,671)	($108,789)	($46,333)	($23,509)	($10,530)	($12,558)
J	($64,287)	($138,802)	($36,095)	($53,893)	$16,245	$8,032
Average	($150,249)	($145,168)	($18,461)	($41,012)	$1,484	($9,158)

Table A4: Actual Change from Baseline in Occurrence of Negative Cash by Cooperative

Coop	Grain Volume	Grain Margin	Fertilizer Volume	Fertilizer Margin	Petroleum Volume	Petroleum Margin
A	0.0	0.0	0.0	0.0	0.0	0.0
B	-0.8	-0.3	-0.1	-0.4	0.0	0.0
C	-1.3	0.0	-0.1	-0.1	0.1	-0.2
D	-0.7	-0.2	-0.2	-1.1	0.0	0.0
E	-0.5	-1.0	-0.1	-0.1	0.1	-0.1
F	0.0	0.0	0.0	0.0	0.0	0.0
G	-0.5	-0.3	0.0	0.0	0.0	0.0
H	0.0	-0.1	0.0	0.0	0.0	0.0
I	-2.2	-0.5	-0.3	-0.2	0.0	0.0
J	-0.1	-0.6	-0.3	-0.2	0.1	0.1
Average	-0.6	-0.3	-0.1	-0.2	0.0	0.0

Table A5: Actual Change From Baseline in Member IRR by Cooperative

Coop	Grain Volume	Grain Margin	Fertilizer Volume	Fertilizer Margin	Petroleum Volume	Petroleum Margin
A	-0.1%	-0.1%	-0.1%	0.0%	-0.1%	-0.1%
B	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
C	-0.4%	-0.4%	-0.2%	-0.1%	0.0%	-0.1%
D	-0.1%	0.0%	0.1%	-0.2%	0.0%	0.0%
E	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
F	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
G	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
H	2.9%	2.9%	2.8%	2.9%	2.9%	2.8%
I	-0.3%	-0.2%	-0.2%	-0.2%	-0.1%	-0.1%
J	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Average	0.2%	0.2%	0.2%	0.2%	0.3%	0.2%

Table A6: Profit Allocation by Cooperatives

Coop	Unallocated Reserve	Cash Patronage Refund	Qualified Stock Patronage Refund	Non-Qualified Stock Patronage Refund
A	0%	50%	50%	0%
B	0%	50%	50%	0%
C	0%	70%	30%	0%
D	0%	50%	50%	0%
E	0%	50%	50%	0%
F	0%	50%	50%	0%
G	0%	21%	79%	0%
H	0%	50%	50%	0%
I	0%	15%	0%	85%
J	0%	50%	50%	0%

Table A7: Equity Retirement System by Cooperative

Coop	Redemption System	Trigger (Age)	Revolving Period (Years)
A	Age	70	20
B	Stock		15
C	Age	70	20
D	Age	68	20
E	Stock		20
F	Age	65	15
G	Stock		25
H	Age	68	20
I	Stock		20
J	Stock		25

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