COALITION DEVELOPMENT IN THE AGRICULTURAL MARKETING SYSTEM

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Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
in partial fulfillment of
the requirements for
the Degree of
DOCTOR OF PHILOSOPHY
August, 2002

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MARKETING SYSTEM

Thesis Approved:

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ACKNOWLEDGMENTS

The following individuals graciously shared their knowledge of institution innovation and coalition theory during this study: Vernon W. Ruttan, Tatsuro Ichiishi, and Jacques Dreze. The Value Added products Cooperative Association at Alva, Oklahoma provided the mailing list and the VAP Cooperative marketing contract to perform the survey. I would also like to thank to Barry L. Bloyd and Oklahoma Agricultural Statistics Service who provided information about the Oklahoma wheat producer non-member of VAP Cooperative discussed in Chapter 4. Jonathan Yoder provided helpful comments on developing of theoretical analysis. My personal discussion with Darrel Kletke about closed cooperative membership inspired valuable thoughts. James N. Trapp always encouraged and provided spirits during the study. Financial support was provided by USDA – Rural Business Cooperative Service.

Many people provided useful comments on various portions of this and related work, Jeff Steichen with his comments and suggestions has improved the quality of this dissertation, including seminar attendees at the Oklahoma State University at Stillwater, the 2001 Southern Agricultural Economics Association Annual Meetings, and 2002 American Agricultural Economics Association Annual Meetings.

My dissertation committee was very helpful. I particularly appreciated Daniel S. Tilley's insightful comments regarding agricultural closed cooperative theory and Brian

Adam's thoughtful questions. Rodney Holcomb provided invaluable advice at every stage of the process, particularly at data collection stage. James Fain consistently challenged and inspired me in developing the game theoretical model of this study. My discussion with Phil Kenkel and his valuable knowledge in closed cooperative's structured have enriched this work.

As always, I have incurred less direct, but equally important, debts of gratitude. My wonderful loving wife, Theresia, who has always supported me and is always proud of me whether I reach my successes or fall short. My dearest son, Mitchell, and my daughters, Valerie and Vanessa, who have always accompanied me with their prayers and provided much love and support. Harjanto Djunaidi was my first agricultural economist role model. My friends at Oklahoma State University, Stillwater and elsewhere have helped me professionally and personally during the dissertation-writing process.

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CHAPTER ONE

INTRODUCTION

"People are still very ignorant about institutions, a unified theory that accepts pluralism is expected." *(Oliver E. Williamson, 2000)*

Overview of the Problem

Within agricultural markets in the United States, new generation cooperatives are one of the most important new institutional innovations. In many states, relatively conservative agricultural producers are investing in relatively risky new generation cooperative ventures. Explaining this phenomenon is an important goal of this dissertation.

Oklahoma's first new generation cooperative Value Added Products (VAP) recently opened in Alva, Oklahoma. The cooperative produces frozen dough products and started operation in 2000. To encourage new generation cooperatives, the Oklahoma legislature passed the "Oklahoma Agricultural Producer Credit Act" for Oklahoma agricultural producers who invest in Oklahoma agricultural processing or marketing ventures (68 O.S. Section 2357.25). This act allows producers/investors to claim an Oklahoma income tax credit of up to thirty percent of their investment in Oklahoma producer-owned agricultural processing cooperatives, ventures or marketing

associations created and designed to develop and advance the production, processing, handling and marketing of agricultural commodities grown, made or manufactured in this state. If the credit allowed exceeds the tax liability, the amount of unused credit may be carried forward for a period not to exceed six years. Several other groups are organizing to form similar cooperatives in Oklahoma.

The investment in many closed cooperatives involves a high degree of risk. Investors should carefully consider the risks associated with alternative investments before making an investment decision. Some of the risks that cooperatives face relate to the ability of the cooperative to attract and retain a reliable customer base and qualified personnel, to expand the marketing channels, and to refine the quality and quantity of the product to meet customer needs.

The risks associated with VAP Cooperative are a prominent consideration because this investment is a start-up enterprise, which currently only sells its product to some big and smaller customers, and its product market (pizza dough) is highly competitive because of direct competition from many companies with far greater resources and experience. In addition, VAP Cooperative relies on a single product line, a limited product distribution system, and is subject to government regulations. VAP Cooperative also depends on its members' obligation to deliver wheat of a certain quantity and quality, and forces members to face the risk that they might be unable to deliver the required wheat to the cooperative.

Throughout the United States, many traditional cooperatives are merging, forming joint ventures and coalitions, or struggling to survive while new generation cooperatives are increasing in size and number. Traditional cooperatives have struggled

to acquire equity because cooperative ownership *per se* conveys no benefit. Benefits generally come only on the basis of patronage. Traditional cooperatives attempt to build equity out of the profit stream. Members receive a portion of their allocated profits in the form of stock. Generally, there is no secondary market for traditional cooperative stock which is redeemed at face value by the cooperative at some future date. New generation cooperatives attempt to solve the equity problems of traditional cooperatives by changing the property rights structure (Cook and Iliopoulos, 2000). New generation cooperatives have a more clearly defined membership policy (closed, or well-defined), a secondary market for members' residual claims, patronage and residual claimant status restrictions, and an enforceable member pre-commitment mechanism. Frequently, new generation cooperatives vertically integrate forward in the distribution chain. Farmers as members/owners attempt to maintain control over their operations, reduce risk, stabilize income, and secure new and existing markets. New generation cooperatives can contribute as an extension of the farm operation that allows farmers to make decisions and have some control over the processing and marketing of products.

Institutions[1] like new generation cooperatives have significant impacts on economic growth and development. The capacity of institutions to change, in response to changes in culture and society, resource endowments, and technology is an important determinant of economic progress in rural areas (Ruttan and Hayami, 1984). A

[1] Institutions are seen both as rules of a society or as organizations that facilitate coordination among people by helping them form expectations which each person can reasonably hold in dealing with others (Ruttan and Hayami, p.204) and unplanned and unintended regularities of social behavior that emerge from the repetitive play of games (Schotter, p. 118).

secondary theme of this dissertation is that the efficiency of the market for institutional innovation is a critical determinant of economic progress.

Effective change occurs when technology, culture, resource endowments and institutions change harmoniously[2]. Dissonance within the marketing system makes adoption at one level in the marketing system extremely unlikely if changes at other levels within the system do not occur simultaneously.

Greater understanding of forces influencing new generation cooperative development could help existing cooperatives make changes to survive and facilitate the creation of new cooperatives. Determinants of the survival and stability of agricultural institutions are theoretically developed and evaluated. Hypotheses from the theory are then tested.

For agricultural economists to be in a position to provide appropriate and effective policy advice to groups considering new generation cooperative formation, they must first understand the nature of the overall cooperative formation process, including its driving forces and essential features. Evaluation of new generation cooperatives requires an understanding of factors that influence the commitment of agricultural cooperative participants to invest and be loyal members.

Clearly the importance of institutional change suggests a need for theoretical models to analyze institutional change as well as empirical analyses. Williamson (2000) suggests that people are still very ignorant about institutions, and he expects a unified

[2] Harmonious has been used at the firm level to describe combinations of fixed inputs whose rates of operation can be combined so that stages within a plant operate at compatible rates (Brems as cited by French, Sammet, and Bressler). This concept is extended here to include compatibility of input and output characteristics, volume of output, as well as rates of production. Dissonant is the opposite of harmonious.

theory that accepts pluralism. Coase (1998), Williamson (2000) and Demsetz (1997) proposed the New Institutional Economics that promises more new ideas for the study of institutions including cooperatives.

Schultz (1990) has noted there is little research analyzing institutional changes in the agricultural marketing system. Within the agricultural marketing system, the capacity for coalition and cooperative formation and management of the legal and social contracts associated with coalitions will be a major determinant of successful structural and institutional development.

A very rich theoretical foundation for the analysis of institutional change can be developed in game theory. Schotter (1986) argued that because of the explicit treatment of rules, game theory is a particularly useful way of analyzing and understanding the probability of institutional or rule evolution. Cooperative game theory remains particularly under-exploited by agricultural economists. The strength and capacity of cooperative game theory for application has been recognized by only a few agricultural economists (Horowitz, Just, and Netanyahu, 1996).

As discussed by Togerson, Reynolds, and Gray (1997), the theory of agricultural cooperatives has a rich history. The development of theory of agricultural cooperatives has led to a greater understanding of many practical problems. For example, the Helmberger and Hoos model provided better understanding of the incentives to limit membership and revealed conflicts of interest (Torgerson, Reynolds, and Gray).

Staatz (1989, p.20) accurately suggests that careful attention must be given to the payoffs facing individual members if defections from cooperatives are to be

prevented. Staatz's conclusion is that distribution of cooperative benefits is a key to preventing defections.

This study extends the previous theory of agricultural cooperatives by integrating investment theory, non-monetary benefits, and fairness into a theory of cooperative development. Most responses to the forces inducing change involve the formation of *coalitions* that frequently require financial investments and have the potential to create non-monetary benefits for members. *Coalitions* in agricultural marketing systems are horizontal and/or vertical groups of individuals or firms within the agricultural marketing system for whom a new set of binding rules or contracts are formed. New generation agricultural cooperatives are coalitions of agricultural producers. The theory of coalitions has been developed largely independently in the economics literature. Both Staatz (1983) and Sexton (1986) have used cooperative game theory to study agricultural cooperatives.

Some evidence indicates that behavioral and economic decisions are driven by fairness considerations (Fehr and Schmidt, 1999; Rabin, 1993; Akerlof, 1979; Okun, 1981; Kahneman et al., 1986). This literatures suggests that producers' perceptions of fairness in distribution of patronage refunds affects their investment decisions in new generation cooperatives. Fairness behavior in cooperative investment involves strategies and decisions either from the cooperative or investors to achieve their maximum expected utility.

The research question is: what is a plausible theory of development for new generation agricultural cooperatives? By knowing this theory, one can explain how non-monetary benefits may influence investment decisions.

The essential difference between this paper and previous studies is that it treats the decision to join a closed cooperative as an investment decision and suggests that non-monetary payoffs and investor's perception of fairness may influence investment decisions. Closed cooperative investments are considered within the context of a portfolio of investment choices a producer can make. A member of a closed cooperative receives specific rights (frequently delivery rights/obligations) in return for his/her investment. These rights are often transferable and may change in value. Payoffs are based on the amount of investment and whether the delivery obligation has been met. The value of the delivery right is expected to be directly related to both the size of the monetary distributions to the members as well as the perceived non-monetary benefits created for members.

The proposed theory assumes that the perceived utility of an investment in a cooperative is related to the size and value of the monetary benefits of membership in a coalition as well as the non-monetary return from the investment. This is consistent with Staatz's finding that the non-monetary benefits that some members may derive from belonging to a cooperative broadens the set of potentially stable solutions (Staatz 1989, p.20). The size and value of benefits of cooperative membership are affected by the business environment and internal decisions of existing cooperatives. The benefits of a coalition are evaluated in utility functions that have monetary and non-monetary benefits, fairness, and risk as arguments.

Without a clear unifying theory of coalitions in agriculture that incorporates the underlying non-monetary motivations and characteristics of the participants, it will be difficult for agricultural economists to develop appropriate hypotheses and complete

appropriate empirical work about cooperative development. Most importantly, producers, policy makers, and other marketing channel participants who need solutions to marketing problems will not have access to the information they need to evaluate new cooperative development.

This dissertation concludes that within the agricultural marketing system, the capacity for coalition and cooperative formation and the management of the legal and social contracts associated with the coalitions will be a major determinant of successful structural and institutional development. This dissertation extends the rich theory of agricultural cooperatives by integrating producers' investment behavior and non-monetary benefits into the theory of cooperative formation using cooperative game theory.

This dissertation contends that the forces inducing change in the supply and demand for institutions have been actively and constantly causing change within agricultural cooperatives. The theory of cooperative development is expanded with emphasis on how non-monetary benefits influence membership investment decisions. Some of the forces inducing change alter producers' perceptions of the actual and potential material payoffs and non-monetary benefits from open and closed cooperative participation or non-participation. Consistent with Sexton (1990) we believe that producers may be motivated to participate in cooperatives because they understand that cooperatives alter decision-making in non-cooperative firms. In addition, consistent with Ladd (1974), cooperatives may also produce non-monetary benefits which are restricted to members and may motivate membership.

Objectives

The general objective of this study is to explain the development of new generation agricultural marketing cooperatives. The specific objectives are:

1. To extend the theory of agricultural cooperatives by incorporating non-monetary benefits, the risk of investment, and fairness into the theory of coalition formation that influence producers' expected utility and investment decisions in new generation agricultural cooperatives;
2. To test whether hypotheses from the proposed theory are supported by empirical evidence about producers' expected utility and investment decisions in an agricultural cooperative.

Procedures

This study has two main sections. The first section explores the theoretical model of cooperative investment that will accomplish objective 1. The theory of agricultural cooperatives is extended by incorporating non-monetary benefits, the risks of investment, and fairness into the theory of cooperative formation. The proposed theory introduces non-monetary benefits into the producers' expected utility functions as a measure of the influences of non-monetary benefits and fairness on the expected utility and investment decisions. In addition, this study also considers the risks associated with the investment choice. The combination of monetary and non-monetary benefits from investment, and the risks associated with investment, represent a considerable enhancement over previous standard models of coalition formation.

The second section of this study deals with formally testing whether hypotheses from the proposed theory are supported by empirical evidence about producers'

investment decisions in agricultural marketing cooperatives. To accomplish this objective, the survey instruments were designed to allow for comparison of the two populations of wheat growers: members of the new generation cooperative, Value Added Products, Inc. (VAP) and wheat growers who are non-members of VAP. This survey was designed to test whether the non-monetary benefits, the risks of investment, and fairness influence cooperative investment decisions and producers' expected utility as members of agricultural closed cooperatives.

Organization of Dissertation

Chapter 2 presents previous literature about research in fairness, factors influencing coalition stability, and the basic model of coalition formation.

Chapter 3 presents a theoretical model of cooperative investment that extends the theory of agricultural cooperatives by incorporating non-monetary benefits, the risks of investment, and fairness into the theory of agricultural cooperatives. This chapter includes a standard model of coalition formation, factors influencing coalition stability, and a proposed model of cooperative investment that incorporates non-monetary benefits and the risks of investment into the analysis of cooperative development.

In chapter 4, the data collection, procedures used to test the hypotheses, and the empirical results of this study are discussed. The dissertation is concluded with a discussion of the implications of these findings for agricultural cooperative investment, agricultural cooperative policy and suggestions for future research in Chapter 5.

CHAPTER II

PREVIOUS LITERATURE

"*The purpose of theory is not to provide answers but to help us ask the proper questions.*"

(George W. Ladd, 1974)

Review of a Basic Model of Coalition Formation

A game in coalitional form specifies, for every coalition of players, a set of monetary payoff vectors that are feasible for players within the coalition if they agree to cooperate. A player can be an agricultural firm or an individual farmer. A coalition is formed and a feasible monetary payoff vector is chosen only when the coalition, the payoff vector and the non-monetary benefits are accepted by all players involved. Membership in the coalitions and the monetary and non-monetary payoffs to each member are the solution to the cooperative game.

The idea of a bargaining set (Aumann and Maschler (1964); Mas-Colell (1989); Zhou (1994)) is used to provide a solution concept that specifies the coalition formation and payoff distribution. By assuming that all players in the game can bargain together with perfect communication, the stability of outcomes of a game depend on objections and counter objections to each coalition that exists. A coalition is stable if all objections can be met by counter-objections. The set of all stable outcomes is called the bargaining set.

Consider an n-person cooperative game Φ, with a given set of n players, $N = \{1,2,\cdots,n\}$. Let $\{C\}$ be the non-empty subsets C of N, called *the permissible coalitions*. For each C, $C \in \{C\}$, a number $v(C)$ is given and it is called *the value of the coalition C*. In the standard model of coalitions, $v(C)$ is measured by material payoffs which are a prerequisite to coalition formation and stability. Assume that all 1-person coalitions in $\{C\}$ have a zero value, i.e.,

(1) $$i \in \{C\}, \qquad v(i) = 0$$

where i is the player in the coalition $\{C\}$ and the value of the coalition C is positive,

(2) $$v(C) \geq 0, \qquad C \in \{C\}$$

A payoff configuration will now be defined as an expression of the form,

(3) $$(x;C) \equiv (x_1, x_2, \cdots, x_n; C_1, C_2, \cdots, C_m)$$

where C_1, C_2, ..., C_m ar e mutually disjoint sets of $\{C\}$ whose union is N, i.e.,

(4) $$C_j \cap C_k = \emptyset, \ j \neq k; \qquad \text{and} \qquad \bigcup_{j=1}^{m} C_j = N$$

and the x_i's are the amounts received by each player (real numbers) which satisfy

(5) $$\sum_{i \in C_j} x_i = v(C_j); \qquad j = 1,2,\cdots,m$$

Thus, a payoff configuration is a representation of a possible outcome of the game, in which the players divide themselves into groups, so-called coalitions, C_1, C_2, ..., C_m, and each coalition distributes its value among its members, and each player receives the amount x_i, for $i = 1,2,\cdots,n$.

When people are faced with a game, logically, it is reasonable that one does not expect that a payoff configuration will occur if $x_i < 0$, since the player i alone can secure more by playing as a 1-person coalition with a zero value. By assuming that

(6) $$\sum_{i \in C} x_i \geq v(C) \quad \text{for each } C,\ C \in \{C\},\ C \subset C_j,\ j = 1,2,\cdots,m.$$

the payoff configuration will be a *coalitionally rational payoff configuration*. Thus, the coalition rationality assumption is very strong as it forces the game to be essentially superadditive.[3] Superadditivity requires that a coalition whose value is less than the sum of the values of disjoint subcoalitions cannot occur in any coalitionally rational payoff configuration.

Usually, the bargaining process starts when each player tries to get at least as much as possible. Thus, during the negotiations prior to coalition formation, each player tries to convince his/her partners that in some sense s/he is worthy of high payoffs. This process can happen in various ways, among which an important factor is a players' ability to show that s/he has other (perhaps better) alternatives. Partners, besides pointing out their own alternatives, may argue in return that even without his/her help they can perhaps keep their proposed shares. A negotiation is a sequence of objections and counter-objections. Stability is reached if all objections can be answered by counter-objections.

The notion of objections and counter-objections can be illustrated using the following example. Let $n = 3$, $v(1) = v(2) = v(3) = v(123) = 0, v(12) = 100$, $v(13) = 100$, and $v(23) = 50$. Suppose the payoff configuration is

[3] A game is superadditive if the value of the union of two disjoint coalitions exceeds the sum of the values of each coalition.

(7) (80, 20, 0; 12, 3)

where 80 represents the amount of payoff received by player 1, 20 represents the amount of payoff received by player 2, and so on. The expression $v(12)$ is the value of the coalition that consists player 1 and 2. In the payoff configuration above the coalition of player 1 and 2 (denoted by *12*) generates the payoff of 100, which can be broken down into 80 units payoff for player 1 and 20 units payoff for player 2. The value of the coalition that consists player 3 alone is zero.

Then, player 2 can object to the payoff configuration by pointing out that in the following payoff configuration,

(8) (0, 21, 29; 1, 23)

s/he and player 3 get more. Regarding player 2's objection, player 1 has no counter-objection because s/he cannot keep his 80 while offering player 3 at least 29. Thus, the configuration represented by equation (7) is an unstable payoff.

On the other hand, the following payoff configuration,

(9) (75, 25, 0; 12, 3)

is a stable outcome. An objection of player 2, for example,

(10) (0, 26, 24; 1, 23)

can be met by a counter-objection

(11) (75, 0, 25; 13, 2)

or an objection of player 1, for example,

(12) (76, 0, 24; 13, 2)

can be met by the counter-objection

(13) (0, 25, 25; 1, 23)

Clearly, in the counter-objections, the threatened player can keep his/her share and offer his/her partners at least what the player who objects offered. The stable payoff configurations in this game are

(14)
(0, 0, 0; 1, 2, 3);
(75, 25, 0; 12, 3);
(75, 0, 25; 13, 2); and
(0, 25, 25; 1, 23)

The formal mathematical definition of objections and counter-objections can be found in Aumann and Maschler (1964, p.448-449).

The essence of the study of cooperative formation is that producers will not join a cooperative unless they receive a benefit from doing so. Sexton (1986) builds the model of cooperative formation based on the assumptions that cooperative membership is voluntary then individuals decide whether to join or not to join based on profit considerations. Clearly, Sexton's model is based on monetary payoffs that specifically emphasize the individual decision makers and their incentives to undertake joint action based upon monetary payoffs.

Previous Research on Fairness

There is conflicting evidence with regard to social behavior in economic research. Reality provides many examples indicating that people are driven by fairness considerations, other evidence indicates that people behave completely selfishly, and still other evidence suggests that motives are crucial (Fehr and Schmidt, 1999). Fehr and Schmidt provide a single simple model that incorporates fairness as "self-centered inequity aversion" to mediate this conflicting evidence. Inequity aversion means that

people resist inequitable outcomes, for example, people are willing to give up some material payoff to move in the direction of more equitable outcomes. Inequity aversion is called self-centered when people do not care *per se* about inequity that exists among other people but are only interested in the fairness of their own material payoff relative to the payoff of others.

Rabin (1993) incorporates the notion of fairness into game theory. The notions of fairness are heavily influenced by the status quo and other players' motives. Interpretation of other players' motives relies on beliefs about their payoffs. This study illustrates whether social goals have important economic implications. Rabin tests whether adding fairness to game theoretic models substantially alters the conclusions. Some evidence indicates that altruistic behavior is more complex and involves elements of fairness. People do not seek uniformly to help other people. They do help people according to how fair other people are. The same producers who are altruistic to other altruistic producers may also be motivated to penalize those who penalize them. These emotions have clear economic implications and suggest that economic behavior is sometimes influenced by social behavior.

Other authors used the notion of fairness to explain why many employers do not cut wages during periods of high unemployment (Akerlof, 1979; Solow, 1980). Arthur Okun (1981) went further in arguing that fairness also alters the outcomes in what he called customer markets. Okun explained his observations by the hostile reaction of customers to price increases that are not justified by increased costs and are therefore viewed as unfair. In Okun's model, customers who suspected that a supplier treated them unfairly are likely to start searching for alternatives. The argument used by these

authors to account for apparent deviations from the simple model of a profit-maximizing firm is that fair behavior is an instrument to the maximization of long-run profits.

The analysis of community standards of fairness that apply to price, rent, and wage setting by firms in varied circumstances and the possible implications of the rules of fairness for market outcomes is important phenomena (Kahneman et al., 1986). A set of scenarios in which a firm (merchant, landlord, or employer) makes a pricing or wage-setting decision that affects the outcomes of one or more transactors (customers, tenants, or employees) is utilized to predict a community standard for actions affecting customers, tenants, and employees. The findings of this study suggest that many actions that are both profitable in the short run and not obviously dishonest are likely to be perceived as unfair exploitations of market power.

Kahneman et al. (1986) identifies some of the criteria that people use in their fairness judgments and demonstrates the willingness of people to enforce fairness at some cost to themselves. Characteristics of transactors provide better predictions about the behavior of the firms. Kahneman et al. (1986) concludes that people care about being treated fairly and treating others fairly, they are willing to resist unfair firms even at a positive cost, and people know that there are implicit rules that specify which actions of firms are considered unfair.

Factors influencing coalition stability

This dissertation provides a scenario that explains major determinants which greatly affect the stability of agricultural cooperatives. Since cooperatives involve interaction between participants, the types of people in the coalition significantly affect

its stability. Recent developments in evolutionary theory (Ostrom, 2000) have begun to provide genetic and adaptive underpinnings for the propensity to cooperate based on the development and growth of social norms, such as social responsibility, trust, and fairness. Ostrom argued that there exist two types of norm using players – *cond itional cooperators* and *willing punishers*[4] – in addition to rational egoists which are the assumption of most economists. A central finding of the theory of collective action is that the world contains multiple types of individuals, some more willing than others to initiate reciprocity to achieve benefits of collective action. Thus, a core question is how potential cooperators signal one another and design institutions that reinforce rather than destroy conditional cooperation.

Conditional cooperators will tend to trust others as long as the proportion of others who return trust is relatively high. Together, conditional cooperators and willing punishers create a more robust opening for collective action and a mechanism for helping it grow. From the experimental findings, the contribution of new assumptions about the type of players needs to be included in a revised theory of collective action. This phenomenon tells us how the structure of collective action and the behavior of a group of players evolves. Some observers call this an evolutionary process that provides useful ways of modeling the emergence and survival of multiple types of players in a group of people. The old-style notion of pre-Mancur Olson that said groups would find ways to act in their own collective interest was not entirely misguided.

[4] Conditional cooperators are individuals who are willing to initiate cooperative action when they estimate others will reciprocate and to repeat these actions as long as a sufficient proportion of the others involved reciprocate. While willing punishers are individuals who are willing to punish others if the circle of relationships allows them to punish those who have contributed less than the minimum level (Ostrom, 2000).

Fairness has economic implications. If somebody is being nice to you, fairness dictates that you be nice to him. Conversely, if somebody is being mean to you, fairness allows that you be mean to him. For example, on the positive side, if an employee has been exceptionally loyal to the company, then a manager may feel some obligation to treat that employee well, even it is not in his self-interest to do so. On the negative side, a consumer may not buy a product that is sold by a monopolist at an unfair price, even if the material value to consumer is greater than the price. By not buying the product, the consumer lowers his own material well-being so as to punish the monopolist.

By modeling such emotions formally, we can understand their economic implications more generally. In this dissertation, a theoretical framework which incorporates such investor's behaviors with respect to socially responsible investment, investment risk, and fairness are engaged into a broad range of coalition development models. Emotions influence people's economic behavior and decisions. Obviously, full and accurate information about all players' types is a very strong assumption for explaining the development of coalitional structures.

The study by Cook and Iliopoulos (2000) clearly supports this research. They conclude that characteristics in a well-defined property rights structured cooperative such as closed membership, obligatory member commitment, and transferable and appreciable equity instruments would result in greater incentives to invest in a cooperative than ill-defined property right policies which characterize the traditional cooperative structure.

Of particular interest in the study of cooperatives is the procompetitive impact of cooperatives on rural communities (Sexton). Sexton has demonstrated the importance of cooperatives as a part of the evolving system. Sexton suggests that in imperfectly competitive markets that are prevalent in rural areas, competition from a cooperative changes the behavior of non-cooperative producers (firms) and creates a competitive yardstick effect (Sexton 1990, p. 718). Sexton's study further identifies that the existence and magnitude of the effect are determined by membership, market structure, and technological conditions. Under many common conditions in agricultural markets, the existence of a cooperative not only provides benefits to the members of the cooperative but also to nonmembers dealing with non-cooperative firms that must compete in a spatial oligopoly with the cooperative firm.

CHAPTER III

THEORETICAL MODEL OF COOPERATIVE INVESTMENT

"Theories are more like graduate students -- once admitted you try hard to avoid flunking them out ... Theories are things to be nurtured and changed and built up."

(Alan Newell, 1990)

Introduction

The analytical frameworks from previous studies that incorporate social and psychological notions into game theory are reviewed in this chapter. Based on previous work, monetary returns, non-monetary benefits, investment risk, and fairness influence cooperative formation and investment decisions. In particular, non-monetary benefits, relatively low investment risk, and fairness can lead to increased cooperation among economic agents in coalitions and increase the stability of coalition solutions.

Most current economic models assume that people pursue only their own material self-interest and do not care about non-monetary goals. History shows, however, that in many economic and social situations, agricultural producers as economic agents prefer to operate in groups rather than on their own (Belleflamme, 2000). People may care not only about their own well-being but also about the well-being of others and derive utility from helping others.

The process modeled in this chapter is the development of a new generation or closed cooperative. This process addresses the dynamic game of producers' investment decisions in the closed cooperative. Initially, a prospectus for the cooperative is written. The prospectus contains the business plan, projections, and risks associated with that enterprise, and is presented to prospective investors/input suppliers for them to evaluate as an` investment in their portfolio of investments. Units of investment give the producer the right to deliver inputs to the cooperative. If enough investor capital and delivery commitments are secured, producers deliver their inputs, and the company operates.

After the first year of operation, the cooperative allocates its earnings to its members (in proportion to delivery) and decides what portion to refund as cash patronage refunds. Members receive the remainder of their allocated patronage refunds in the form of stock. The cooperative also usually reports its earnings to the members in a written report delivered at an annual meeting of the stockholders. The value of the investment changes as conditions affecting the cooperative's business change and the cooperative develops a history of earnings and cash patronage distributions. Using the information in the prospectus, the outcome for the first year, and expectations for the future, each producer can elect to buy or sell delivery rights and evaluates whether to deliver inputs to the cooperative so that s/he participates fully in next year's patronage distribution.

A producer decision is treated as an investment decision. Producer utility is a function of monetary and non-monetary benefits, investment risk, and fairness. Producers maximize utility subject to a wealth constraint. By formally modeling

producers' utility, their economic implications to the cooperative development are better understood.

The Model

An integrated model of cooperative investment based on game theory is proposed. This model explains coalition development, factors influencing coalition stability, and the producers' perceptions of the actual payoffs from coalition participation. Coalition structures and their evolution are examined.

Dynamic Games with Perfect Information

We consider the process of decision making in a closed cooperative investment as a dynamic game between the cooperative and the investors. In order to determine the set of strategies for either the cooperative association or the investors, the moves the players have, the order in which they choose these moves, and the information they have when they make their decisions must be specified. One way to organize this information is through the development of a game tree.[5] Decision nodes in the game tree are represented by boxes, which contain the identity of the player who moves at that node. A branch represents a possible move by a player. Every branch connects two nodes and has a direction which is depicted by an arrowhead.

Figure 1 displays the game tree for a dynamic closed cooperative formation and operation game. The game begins at the top of the game tree where the cooperative association initially writes a prospectus for the closed cooperative. For simplicity, it is assumed the cooperative either offers an optimistic or conservative prospectus as shown

[5] A game tree is a picture composed of nodes and branches, where each node in the game tree represents a decision point for one of the players and is said to belong to the player that moves at that point.

by each branch. Each branch points to a decision node for the producers since producers make their investment decisions after they learn and evaluate the type of strategies the cooperative has adopted. From each of the two decision nodes extend two branches representing the two possible moves producers can make. Again the decision is simplified as a decision to invest or not to invest. If an insufficient number of producers decide to invest, a cooperative firm does not form.

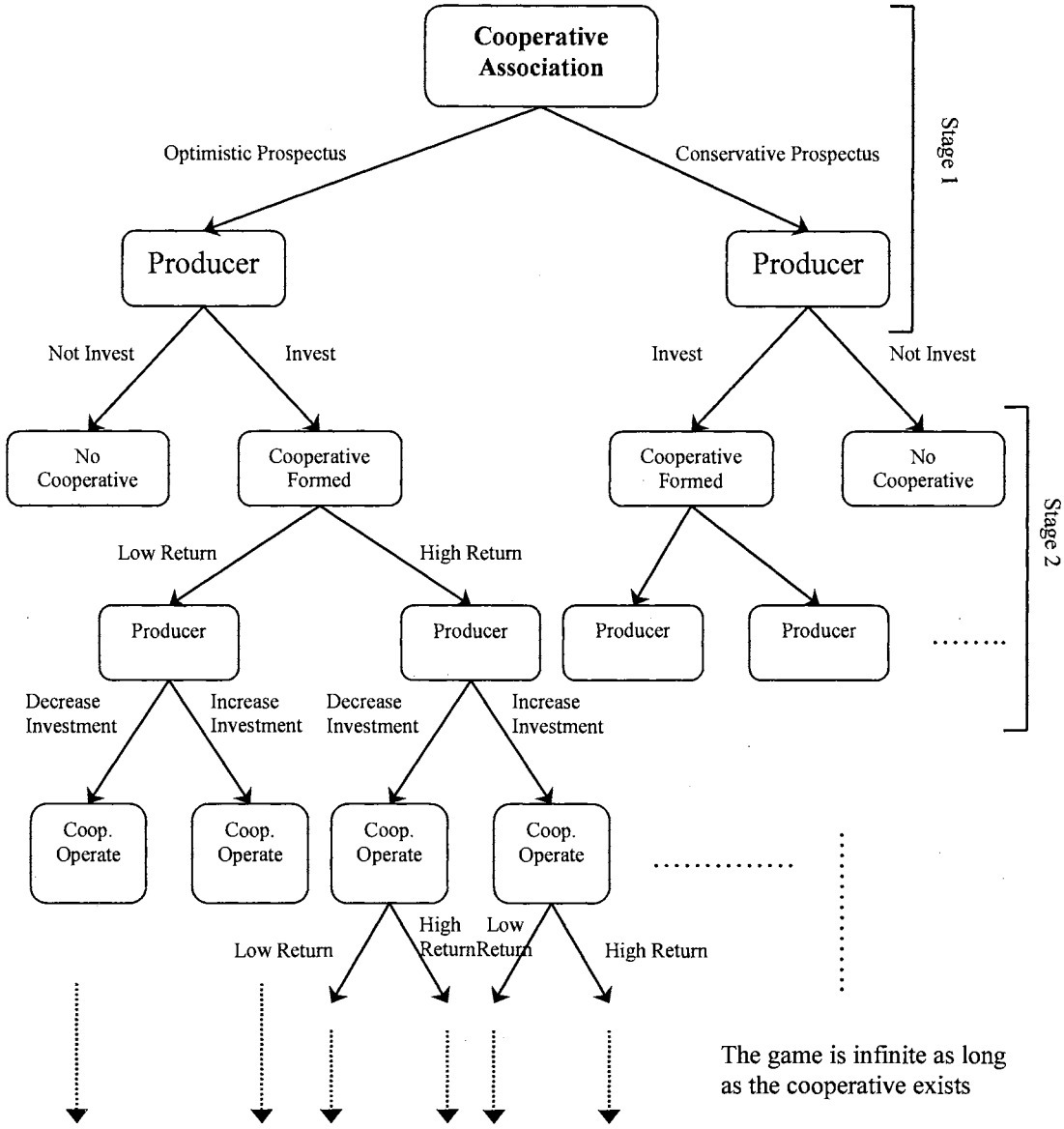

Figure 1. The Game Tree for Dynamic Games in the Case of Closed Cooperatives

Units of investment give the producer delivery rights to the cooperative, and the value of the investment will change if conditions affecting the cooperative's business change. If enough investor capital and delivery commitments are secured, then producers deliver their inputs, and the company operates for the year. As the cooperative operates its business, it develops a history of earnings and cash patronage distributions to its members. At the cooperative's decision nodes, cooperatives elect to distribute high or low cash patronage refunds. Again, to simplify the game tree, a continuous decision is treated as two discrete choices.

Using the outcome for the first year, and expectations for the future, each producer can decide to buy more or sell (transfer) stock/delivery rights. They also decide how much to deliver so they can participate in next year's patronage distribution. The sequential decision making process continues as long as the firm exists.

A Model of Agricultural Marketing Cooperative

An integrated model of coalition development is a model that considers major determinants influencing the stability of coalitions. Investment decisions and non-monetary benefits from the cooperative investment are incorporated into the analysis of the model of cooperative membership. The crucial feature of the model is how producers' investment decisions and non-monetary benefits from the investment affect the stability of coalition structures. Another important aspect of this model is the effect of fairness on welfare allocations. Two important elements of fairness are the *actual outcome* of an action, and the *expected outcome* (reference point) from membership.

Investors' utility is assumed to depend not only on the material benefits but also on non-monetary benefits, the risk associated with the investment, and fairness. Fairness is formalized in the framework developed by Rabin (1993). Rabin's model incorporates fairness into economic research. He modifies conventional game theory by allowing payoffs to depend on fairness. We assume investors are more likely to invest in a cooperative as part of their portfolio if that investment is perceived to be fair, to have relatively low risk, and to provide non-monetary benefits. This section applies the theory of coalition development to the development of a closed agricultural processing cooperative. The core of the coalition development process is the value of cooperative investment which consists of both monetary and non-monetary benefits. Basically investors will not join a cooperative unless the benefits from doing so exceed the costs of joining.

Producers are presented with a prospectus for an agricultural marketing cooperative that will add value to the raw commodity they produce. To join this coalition, an investor must be an agricultural producer and produce the raw material further processed by the cooperative.

Members are provided the rights to subscribe for and purchase shares of common stock in the cooperative, and also agree to deliver raw material to the cooperative each year. The cooperative association distributes one delivery right for each share of common stock held on the record date. Each delivery right entitles an eligible member to deliver one unit of commodity. For example, a member may exercise the rights to purchase a minimum of 1,000 shares for $5,000. Each year the producer has the obligation to deliver 1,000 bushels of wheat. If the cooperative is

profitable, the ownership shares and the delivery rights will appreciate in value and surpluses generated by the cooperative will be distributed to the members as stock and/or cash in proportion to how much of the raw product (wheat) they deliver annually. The potential appreciation in share value and the cash patronage refund represent the monetary benefits from membership.

Unlike previous work by Sexton, we assume that investors maximize expected utility of the investment, and their utility function includes the expected monetary benefits from investment, risk, fairness, and non-monetary benefits and is maximized subject to their wealth constraint. Membership in a new generation cooperative is assumed to be voluntary and potential members choose whether to invest or not to invest in a cooperative based on monetary, non-monetary benefits, fairness, and risk. Non-monetary benefits are included because the firm is located in an area in which the producer may want to create employment opportunities and support economic development.

Investment theory and previous work about "revealed preference" conditions for validity of the utility maximization model are used and extended (Varian, 1983). The mean-variance model of cooperative investment captures the investor's rationality in undertaking investment decisions based on the expected return on investment, risk, fairness, and non-monetary return associated with the investment. The substantial difference between this model and Varian's work are the non-monetary benefits and fairness terms in the investor's utility function.

The Mean-Variance Cooperative Portfolio Model

For notational purposes, we need to define the variables used in our equations. Let $p = (p_1, \ldots, p_A)$ denote the vector prices of the assets. $x = (x_1, \ldots, x_A)$ represents the assets or portfolio choices. The variable $R = (R_1, \ldots, R_A)$ denotes expected return on the portfolio choices 1, ..., A and $G = (G_1, \ldots, G_A)$ represents the non-monetary benefits from portfolio x. The investor's expected return of portfolio x is denoted by $W = Rx$; f is a vector of the investors' perception of fairness for each asset $f = (f_1, \ldots, f_A)$, and W_o represents initial level of wealth. $U(\mu, \sigma^2, D, F \cdot)$ is the von Neuman-Morgenstern utility function which is enhanced with non-monetary benefits, risk, and a fairness component.

The risks associated with cooperative investment as part of producers' portfolio are represented by variance of return on investment from the portfolio x. The variance of return from portfolio x is represented by $\phi x'Vx$ where $\phi < 0$ is the risk-aversion parameter, and V is the variance/covariance matrix of the investments x. The investor's utility from portfolio x has a mean μ and variance σ^2. Utility is a function of expected return on investment, the variance of return from the portfolio, perception of fairness, and non-monetary benefits associated with that portfolio choice. Producers are hypothesized to maximize utility subject to a wealth constraint:

$$\max_x U(Rx, \phi x'Vx, Gx, fx)$$

$$\text{subject to } p \cdot x = W_o$$

$$\text{and } x \geq 0$$

Definition 1. We have observed a portfolio choice x^i for $i = 1,\ldots,n$, a mean-variance utility function rationalizes the observed investor behavior if and only if

(5) $$U(Rx^i, \phi x^{i\prime} V x^i, Gx^i, fx^i) \geq U(Rx, \phi x' V x, Gx, fx)$$

for all portfolios x that cost the same or less than x^i. That is: $p^i x \leq p^i x^i$ or $p^i(x - x^i) \leq 0$. This expression tells us that given the expected return R, variance/covariance matrix V, non-monetary return vector G, and fairness vector f, investors decide to invest in the cooperative membership if the expected utility from a portfolio containing a cooperative investment exceeds any other affordable portfolio.

There are two ways of proving that Equation 5 is true. Necessary and sufficient conditions for Equation 5 can be derived using either Slutsky conditions or revealed preference conditions (Varian, 1983). Revealed preference conditions are used because this approach is more applicable for empirical analysis. The necessary and sufficient conditions for the mean-variance utility maximization of Equation 5 are described in Theorem 1.

Theorem 1. If we assume that the mean-variance utility function is a monotonic, concave, and differentiable, then we know from the standard properties of concave functions that for x^i and x^j,

(6) $$U(x^i) \leq U(x^j) + U'(x^j)(x^i - x^j) \qquad i, j = 1,\ldots,n.$$

Furthermore the hypothesis of utility maximization implies that first-order conditions must be satisfied by the data. That is

(7) $$U'(x^j) = \lambda^j p^j \qquad j = 1,\ldots,n \text{ and } \lambda^j > 0$$

For the utility function represented in Equation 5, Equations 6 and 7 are rewritten as Equations 8 and 9.

(8)

$$U^i \le U^j + M^j(Rx^i - Rx^j) + E^j(Gx^i - Gx^j) + S^j(\phi x^{i\prime} Vx^i - \phi x^{j\prime} Vx^j) + H^j(fx^i - fx^j)$$
$$i, j = 1, \ldots, n$$

(9) $$M^j R + E^j G + 2S^j \phi x^{j\prime} V + H^j f = \lambda^j p^j \qquad \text{with } j = 1, \ldots, n \text{ and } \lambda^j > 0$$

where $$U^i = U(Rx^i, \phi x^{i\prime} Vx^i, Gx^i, fx^i);$$

$$M^j = \frac{\partial U(Rx^j, \phi x^{j\prime} Vx^j, Gx^j, fx^j)}{\partial (Rx^i)};$$

$$E^j = \frac{\partial U(Rx^j, \phi x^{j\prime} Vx^j, Gx^j, fx^j)}{\partial (Gx^j)};$$

$$S^j = \frac{\partial U(Rx^j, \phi x^{j\prime} Vx^j, Gx^j, fx^j)}{\partial (\phi x^{j\prime} Vx^j)};$$

$$H^j = \frac{\partial U(Rx^j, \phi x^{j\prime} Vx^j, Gx^j, fx^j)}{\partial (fx^j)}$$

$\lambda^j =$ marginal utility of income.

Equation 8 is the standard requirement for utility maximization which is property of concavity from Equation 6, and Equation 9 is the first-order conditions of the utility function that satisfied the Equation 7. Given the information about (p^i, x^i), we can show $U^i, M^i > 0, E^i > 0, S^i < 0, H^i > 0 \text{ and } \lambda^i > 0$ then Equation 8 holds and our mean-variance utility function is concave, differentiable, and monotonic.

Proof. Equation 8 describes the standard properties of concave functions and Equation 9 is the usual first-order conditions of the mean-variance utility function. We

assume $U(x^i)$ exist, $M^i > 0, E^i > 0,\ S^i < 0,\ H^i > 0$ and $\lambda^i > 0$. That is the marginal utility of monetary returns is positive, the marginal utility of non-monetary benefits is also positive, the marginal utility of risk is negative, the marginal utility of fairness is positive, and the marginal utility of income is positive as well.

We must show that given any x with $p^i x^i \geq p^i x$, $U(x^i) \geq U(x)$. In deriving the sufficient conditions for the mean-variance utility maximization model we need to define:

(10)
$$U(Rx, Gx, \phi x'Vx, fx) = \min_i \{U^i + M^i(Rx - Rx^i) + E^i(Gx - Gx^i) + S^i(\phi x'Vx - \phi x^{i\prime}Vx^i) + H^i(fx - fx^i)\}$$

Since the variance-covariance matrix V is positive semi-definite, for all x^i and x we can write the variance of portfolio x as $(x - x^i)'V(x - x^i) \geq 0$. By arranging this inequality we get the algebraic identity $(x'Vx - x^{i\prime}Vx^i) \geq 2x^{i\prime}V(x - x^i)$.

Now suppose that some x such that $p^i x^i \geq p^i x$. For notational convenience, let us define $U^i = U(x^i)$. Then we have

(11)
$$U(Rx, Gx, \phi x'Vx, fx) = \min_i \{U^i + M^i(Rx - Rx^i) + E^i(Gx - Gx^i) + S^i(\phi x'Vx - \phi x^{i\prime}Vx^i) + H^i(fx - fx^i)\}$$

(12)
$$U(Rx, Gx, \phi x'Vx, fx) \leq U^i + M^i(Rx - Rx^i) + E^i(Gx - Gx^i) + S^i(\phi x'Vx - \phi x^{i\prime}Vx^i) + H^i(fx - fx^i)$$

which can be rewritten as:

(13)
$$U(Rx, Gx, \phi x'Vx, fx) \leq U^i + M^iR(x - x^i) + E^iG(x - x^i) + 2S^i\phi x^{i\prime}V(x - x^i) + H^i f(x - x^i)$$

(14)
$$U(Rx, Gx, \phi x'Vx, fx) \leq U^i + (M^iR + E^iG + 2S^i\phi x^{i\prime}V + H^i f)(x - x^i)$$

because $M^i R + E^i G + 2S^i \phi x^{i\prime} V + H^i f = \lambda^i p^i$ then we can say

(15) $$U(Rx, Gx, \phi x'Vx, fx) \leq U^i + \lambda^i p^i (x - x^i).$$

Since $p^i(x - x^i) \leq 0$, then

(16) $$U(Rx, Gx, \phi x'Vx, fx) \leq U^i \text{ and}$$

(17) $$U(Rx, Gx, \phi x'Vx, fx) \leq U(Rx^i, Gx^i, \phi x^{i\prime} Vx^i, fx^i)$$ ■

Rationalizing the observed behavior of investors using a differentiable, concave, monotonic utility function will guarantee the existence of U^i, $M^i > 0$, $E^i > 0$, $S^i < 0$, $H^i > 0$ and $\lambda^i > 0$ that satisfy the inequalities: $U^i \leq U^j + \lambda^j p^j (x^i - x^j)$ for $i, j = 1, \ldots, n$. If there exist some values $U^i, M^i > 0, E^i > 0, S^i < 0, H^i > 0$ and $\lambda^i > 0$ for $i = 1, \ldots, n$ that satisfy the inequalities above for some observed behavior of investors (p^i, x^i), $i = 1, \ldots, n$, then there must exist a continuous, concave, monotonic utility function that rationalizes the observed behavior.

Stage I: Initial Investment Decision

The investor's interest is choosing x^i to maximize utility. Changes in x^i are changes in demand for investment. Suppose that x^i is chosen to maximize the investor's utility. Let $\mu(x^i)$ be the monetary returns, $D(x^i)$ be the non-monetary benefits, $\sigma^2(x^i)$ be the variance of returns, and $F(x^i)$ represents fairness.[6]. For example, the amount of delivery rights purchased monetary and non-monetary benefits, risks, and

[6] In initial investment decision analysis the notations μ, D, σ^2, and F are used for derivation purposes instead of $Rx^i, Gx^i, \phi x^{i\prime} Vx^i$, and fx^i, to make the utility function more general.

perception of fairness. Let us denote the maximum utility as $M(x^i)$ for different choices of x^i.

$$M(x^i) \equiv \max_{x^i} U\left(\mu(x^i), D(x^i), \sigma^2(x^i), F(x^i)\right)$$
$$\text{subject to } g(x^i, W_0) = 0 \text{ and } x^i \geq 0$$

so that the Lagrangian is

(18) $$L(x^i, \lambda) = U\left(\mu(x^i), D(x^i), \sigma^2(x^i), F(x^i)\right) - \lambda g(x^i, W_0)$$

and the first-order conditions with respect to x^i and λ are

(19) $$\frac{\partial L}{\partial x^i} = \left(\frac{\partial U\left(\mu(x^i), D(x^i), \sigma^2(x^i), F(x^i)\right)}{\partial \mu}\right)\left(\frac{\partial \mu(x^i)}{\partial x^i}\right) +$$
$$\left(\frac{\partial U\left(\mu(x^i), D(x^i), \sigma^2(x^i), F(x^i)\right)}{\partial \sigma^2}\right)\left(\frac{\partial \sigma^2(x^i)}{\partial x^i}\right) +$$
$$\left(\frac{\partial U\left(\mu(x^i), D(x^i), \sigma^2(x^i), F(x^i)\right)}{\partial D}\right)\left(\frac{\partial D(x^i)}{\partial x^i}\right) +$$
$$\left(\frac{\partial U\left(\mu(x^i), D(x^i), \sigma^2(x^i), F(x^i)\right)}{\partial F}\right)\left(\frac{\partial F(x^i)}{\partial x^i}\right) - \lambda\left(\frac{\partial g(x^i, W_0)}{\partial x^i}\right) = 0$$

(20) $$\frac{\partial L}{\partial \lambda} = g(x^i, W_0) = 0 \qquad \text{for } i = 1, \ldots, n$$

These conditions determine the optimal choice of x^i which in turn determines the maximum utility function $M(x^i) \equiv U\left(\mu(x^i), D(x^i), \sigma^2(x^i), F(x^i)\right)$.

Since $\mu = Rx^i$; $D = Gx^i$; $\sigma^2 = \phi x^{i\prime} V x^i$; $F = fx^i$ and $g(x^i, W_0) = p^i x^i - W_0$ then the investment demand function is

(21) $$x^{i^*} = x^{i^*}(R, G, \phi V, f, p^i, W_0)$$

The envelope theorem[7] gives a formula for the derivative of maximum utility function with respect to choice variable x^i:

$$\frac{dM(x^i)}{dx^i} = \frac{\partial L}{\partial x^i}$$

(22) $$\frac{dM(x^i)}{dx^i} = \left(\frac{\partial U\left(\mu(x^i), D(x^i), \sigma^2(x^i), F(x^i)\right)}{\partial x^i}\right) - \lambda\left(\frac{\partial g(x^i, W_0)}{\partial x^i}\right)$$

This equation shows how the maximum utility changes, given changes in x^i.

Stage II: Closed Cooperative's Decision Model

The closed cooperative's objective function is to maximize net surplus, and the cooperative surplus function is determined by revenue, total production costs, and cash patronage refunds. Suppose there is a coalition *S* of *M* potential investors in a closed cooperative, $M = (1,\ldots,m)$. We assume that closed cooperative (coalition *S*) produces consumer product, *k*, using purchased input from non-members plus input from members, z_k, where the marginal cost of producing *k* is $c(z_k)$ and the total cost is $C(z_k)$. From our derivation of the investor's demand for cooperative investment we have $x^{i*} = x^{i*}(R, G, \phi V, f, p^i, W_0)$. Assume this is a continuous and differentiable for all variables in the model.

The aggregate demand for cooperative investment from the cooperative members in coalition *S*,

(23) $$x_S^{i*} = \sum_{j \in S} x_j^i(R, G, \phi V, f, p^i, W_0) \text{ for } S \subseteq M$$

[7] The proof of the envelope theorem can be found in Varian (1992) p. 502.

where $x_S^{i^*}$ is equivalent to owners equity which is determined by Equation 21 in Stage I. Total investment capital, K_k, can be obtained from owners equity and/or loans. Let L_k is the amount of investment capital to produce consumer product k from loans that is proportional to amount of capital invested/owners equity in the cooperative, $L_k = \gamma(x_S^{i^*})$ where γ is the loan leverage parameter. The cooperative investment capital is $K_k = x_S^{i^*} + \gamma(x_S^{i^*}) = (1+\gamma)x_S^{i^*}$.

Let $\theta_j(z_k, K_k)$ be the revenue that an investor obtains from an investment in a closed cooperative. Then we can say that the revenue for cooperative as a coalition S is $\theta_S(z_k, K_k) = \sum_{j \in S} \theta_j(z_k, K_k)$ since $j \in S$. If the cooperative's production function is $y_S^i = h(z_k, K_k)$, then cooperative's revenue can be written as $\theta_S(z_k, K_k) = p_S^k \cdot h(z_k, K_k)$, where p_S^k is the price of consumer product k. The cooperative's surplus is:

(24) $$\Pi'(z_k, K_k) = \max\left(\theta_S(z_k, K_k) - C(z_k)\right) \quad \text{for } z_k > 0$$ [8]

where $C(z_k) = w_z \cdot z_k$ is the total production costs associated with producing k and w_z is the price for one unit of raw material/input. If z_k^* is the optimum quantity of input that maximizes $\Pi'(z_k, K_k)$, then we will get $z_k^* = 0$ if $\theta_S(z_k, K_k) \le C(z_k)$ for all $z_k > 0$.

The cooperative's retained earnings (*RE*) are:

(25) $$RE(z_k, K_k) = \Pi''(z_k, K_k) = \Pi'(z_k, K_k) - R_S(z_k) \quad \text{for } \Pi'(z_k, K_k) > R_S(z_k)$$

[8] The investment capital, K_k, is a constant term which determined and fixed from Stage I of closed cooperative investment game tree. We assume that the cost of owner equity and loans are fixed.

where $R_S(z_k) = w_r \cdot z_k$ is the cash patronage refunds which can be earned by investors in coalition S with w_r as the book value of each share of common stock at the present time. We can express the cooperative's retained earnings, *RE*:

(26) $$RE(z_k, K_k) = \max[\Pi''(z_k, K_k), 0]$$

The cooperative's retained earnings $RE(z_k, K_k) = 0$ if cooperatives are not profitable to deliver $R_S(z_k)$ to investors or if not enough capital and delivery commitments. In either case, the cooperative fails to operate.

To formally derive the cooperative maximizing behavior, Equation 24 may be rewritten as an optimization problem:

(27) $$\Pi'(z_k, K_k) = \max_{z_k} \Pi\left(p_S^k \cdot h(z_k, K_k) - w_z \cdot z_k\right)$$

$$\text{subject to } w_r \cdot z_k \le E \text{ and}$$

$$z_k > 0$$

where E is the maximum amount of shares allowable to be offered by the cooperative, and w_r is the initial book value of each share of common stock (one share is equivalent to one unit of input delivered).

The Lagrangian function is

(28) $$L(z_k, K_k, \lambda) = [p_S^k \cdot h(z_k, K_k) - w_z \cdot z_k] - \lambda(w_r \cdot z_k - E)$$

By assuming that $h(z_k, K_k)$ is differentiable then the first-order and the second-order conditions with respect to z_k and λ are

$$\frac{\partial L}{\partial z_k} = p_S^k \cdot h'(z_k, K_k) - w_z - \lambda w_r = 0$$

$$\frac{\partial L}{\partial \lambda} = -(w_z \cdot z_k - E) = 0$$

$$\frac{\partial^2 L}{\partial z_k^{\,2}} = p_S^k \cdot h''(z_k, K_k) \le 0 \text{ and } \frac{\partial^2 L}{\partial \lambda^2} = 0$$

then we get competitive factor demand,

(29) $$z_k^* = z_k^*(p_S^k, w_z, w_r, E)$$

so the solution for the supply function maximizing the cooperative net surplus is

(30) $$y_S^{i\,*} \equiv h\left\{z_k^*(p_S^k, w_z, w_r, E), K_k\right\}$$

The Role of Fairness

Suppose there is a two-player cooperative game with perfect information. The two players are the cooperative and an investor. The mixed strategy sets are T_M and T_C for the investors and the cooperative, respectively. Let $(R \cdot x^i)_M$ be the investor's expected return of portfolio choice x^i. We assume that maximization of each player's expected utility is determined by their chosen strategy and their beliefs about the other player's strategy choices. Let $a_M \in T_M$ and $a_C \in T_C$ be the strategies chosen by the investor and the cooperative, respectively. The investor's beliefs about the strategy the cooperative is choosing is represented by $b_C \in T_C$, and the cooperative's beliefs about what strategy the investor is choosing is represented by $b_M \in T_M$.

The fairness term *f* measures how fair an investor perceives the treatment of other players (cooperative) in the coalition. To formalize the investor's perceptions, it is necessary to develop a model that explicitly incorporates beliefs. The term $f_C(a_C, b_M)$ explains how fair the cooperative is being by choosing strategy a_C. If the

cooperative believes that the investor is choosing strategy b_M. The term $f_C(a_C, b_M)$ measures how much more than or less than investor's equitable payoff, the cooperative believes the association is giving to the investor. The cooperative has the opportunity to choose the payoff pair $[R_C(a_C, b_M), R_M(b_M, a_C)]$ from among the set of all feasible payoffs if the investor is choosing strategy b_M. The investor's equitable payoff is expressed by the following relationship $R_M^e(b_M) = [R_M^h(b_M) + R_M^l(b_M)]/2$. $R_M^e(b_M)$ provides a reference point against which to measure how fair the cooperative is perceived as being to the investor, where $R_M^h(b_M)$ is the investor's highest payoff in $X(b_M)$ and $R_M^l(b_M)$ is the investor's lowest payoff among points that are Pareto-efficient[9] in $X(b_M)$. The feasible set of Pareto-efficient points are the points in the set $X(b_M) \equiv \{(R_C(a, b_M), R_M(b_M, a)) \mid a \in T_C\}$, where $X(b_M)$ is the set of alternative payoff combinations R_C and R_M; and T_C is the set of pure strategies of the cooperative. The term $X(b_M)$ looks at the set of payoff combinations from the cooperative's perspective, and the cooperative takes into account its belief about which strategy the investor will choose (b_M). Accordingly, $X(b_M)$ reflects the cooperative's belief about all players' payoff combinations in the opportunity set.

From these payoffs, the fairness term is defined. This term captures how much more than or less than investor's equitable payoff the cooperative believes the association is giving to investor.

Definition 2. The perception about the cooperative's fairness to the investor is given by

[9] Pareto-efficient is a point in which it is not possible to make one person better off without making at least one other person worse off. The pareto-efficient situation always reflects optimal point in the set of feasible points.

(31) $$f_C(a_C, b_M) \equiv \frac{R_M(b_M, a_C) - R_M^e(b_M)}{R_M^h(b_M) - R_M^l(b_M)}$$

If $R_M^h(b_M) - R_M^l(b_M) = 0$ then all of the cooperative's responses to strategy b_M provide investor the same payoff. Therefore, there is no fairness issue and $f_C(a_C, b_M) = 0$. Clearly, $f_C(a_C, b_M) = 0$ if and only if the cooperative gives the investor the equitable payoff. If $f_C(a_C, b_M) < 0$ the cooperative is giving the investor less than the equitable payoff. Finally, if $f_C(a_C, b_M) > 0$ the cooperative is giving the investor more than the equitable payoff. The investor's fairness to the cooperative is given by $f_M(a_M, b_C)$. If the investor believes that the cooperative is choosing strategy b_C then the term $f_M(a_M, b_C)$ measures how fair the investors are being to the coopertative. Figure 2 shows the outcome term $f_C(a_C, b_M)$ as a function of the level of payoff (R_M's). This figure captures the producer's perception of fairness: the higher the investor's payoff offered by the cooperative is compared to the equitable payoff, the higher the perception of fairness.

The central feature of this fairness term is that if investors believe that the cooperative is treating them unfairly, then $f_C(a_C, b_M) < 0$, and the investor wishes to respond to the cooperative negatively by choosing strategy a_M such that $f_M(a_M, b_C) < 0$. However, if cooperative is delivering fair action to investors, $f_C(a_C, b_M) > 0$, and then investors will provide the cooperative fair feedback.

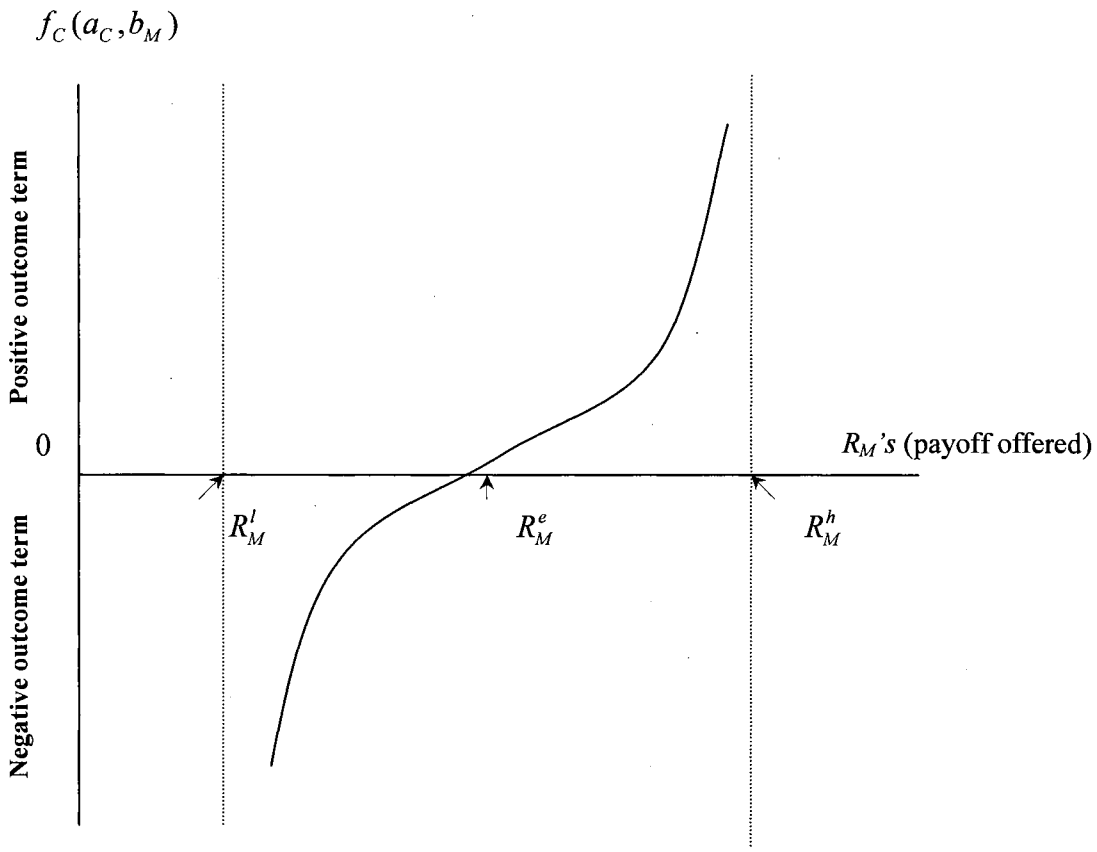

Figure 2: The Outcome Term as a Function of the Level of Payoff Offered for a Given Motivation Factor

Hypotheses

This theory of cooperative investment shows that the cooperative enterprises that generate maximum expected utility to producers are preferred more than those that do not. Joining a closed cooperative may increase the investor's risk, especially if it is a start-up enterprise. There must be a meaningful reason that encourages investors to invest in a closed cooperative. Equation 21 in the previous section clearly generates three hypotheses related to the closed cooperative investment decisions. The first question to be addressed in this analysis then is whether non-monetary benefits from cooperative investment motivate producers to invest in a closed cooperative. Therefore, the first hypothesis is:

H_1: Producers who want to create employment opportunities and support economic development in their local community are more willing to invest in a cooperative as part of their portfolio if that investment provides those non-monetary benefits.

The impact of risks associated with cooperative investment on producer's expected utility and investment decisions is an important issue in this study. The second hypothesis is:

H_2: Risk-averse producers are more willing to invest in a closed cooperative if they perceive that investment to have relatively low risk.

The third hypothesis is related to the psychological literature that eventually was used to study the implications of fairness in economic transactions. Evidence indicates that people's notions of fairness are heavily influenced by the status quo and other

reference points (Rabin, 1993; Kahneman et al., 1986a, b). Following this reasoning, the third hypothesis is:

H_3: Producers who are concerned about fairness are more willing to invest in a closed cooperative if that enterprise provides treatment that is perceived as fair.

Summary

The forces inducing change in agricultural cooperative institutions have led to the demand for a clear unifying theory of agricultural marketing cooperative development. A model of new generation cooperative investment based on investment theory is proposed by incorporating monetary, non-monetary, fairness, and risk components in the model. Our model incorporates non-monetary perception of the investors as an essential determinant influencing the formation of a cooperative. Investors judging whether or not to invest in a new generation cooperative not only consider monetary benefits from their investment but non-monetary benefits, fairness and risk as well.

The closed cooperative investment involves a high degree of risk compared to many other investments. New generation cooperatives attempt to solve the equity problems of traditional cooperatives by changing the property rights structure. New generation cooperatives have a more clearly defined membership policy, a secondary market for members' residual claims, patronage refund claimant status restriction, and an enforceable member pre-commitment mechanism.

The mean-variance cooperative portfolio model is proposed to capture the investor's rationality in undertaking investment decisions. As predicted, the rational

investors will decide to invest in the closed cooperative as part of his portfolio if the expected utility of a portfolio containing a closed cooperative investment exceeds the utility from any other affordable portfolio.

The role of fairness in the new generation cooperative investment model captures several important issues of investor behavior. Investors' perception of fairness is heavily influenced by their reference points. For instance, the investors' view of the fairness of closed cooperative' management to the members can be influenced by how that firm has treated them in the past relative to their expectation.

The model of closed cooperative investment can be viewed from a game theoretical approach as a sequential game with perfect information. In the cooperative formation stage, the potential investors observe the cooperative's management behavior, and this provides information on which investors make their investment decisions. In this game, the cooperative's management behavior can conceivably change the motivation of the investor to invest. A sequential game involves sequential strategies and a decisions process, and it will continue as long as the firm exists.

In the earlier stage, the success of a coalition formation is greatly determined by the prospectus of that cooperative. If the cooperative's prospectus provides overly optimistic investment return expectations, initial positive perceptions may be created. In the second stage of the game, the investors have two alternative strategies: increase or decrease the investment for the next period of the operation. The decision is determined by utility as a member of the closed cooperative. If the cooperative delivers high utility to its members, again the investors will respond positively to the cooperative's management and increase their investment. Investors maximize utility subject to a wealth constraint

and they will decide to invest in the cooperative if the expected utility from a portfolio containing a cooperative investment exceeds any other affordable portfolio. Sequentially, the cooperative maximizes net surplus subject to maximum allowable shares to be offered to investors.

The initial investment decision analysis provides the optimal value of demand for a closed cooperative investment in achieving maximum utility as a function of monetary return, social/non-monetary benefits, variance of the return, and fairness. Further research is obviously required, since comprehensive analysis with respect to the closed cooperative point of view needs to be developed. This study has provided the results from the investor side, and part of the analysis obtains and derives the supply function of the closed cooperative investment. The closed cooperative's production function was hypothesized as a function of purchased input from non-members plus input from members and investment capital. Although this is a very general hypothesis and requires further research, the cooperative management needs to consider this issue as important attribute to maintain a successful enterprise.

CHAPTER IV

EMPIRICAL ANALYSIS

Introduction

This chapter presents the survey design and questionnaire used to generate the data for testing the hypotheses from the theoretical model. The research question is: Do non-monetary benefits from investment, perception of fairness, and investment risk affect producers' expected utility and their investment decisions?

Previous studies have not incorporated non-monetary benefits and investment risk into cooperative development and producers' decisions to invest in an agricultural cooperative. In addition, procedures for defining variables that account for the measurement of non-monetary benefits and investment risk on the investors' expected utility and investment decisions are presented. A questionnaire is used in a cross-sectional survey of wheat producers as a data generating instrument to test the hypotheses suggested in Chapter 3.

The questionnaire generates information about the producers' demographic characteristics such as age, gender, education level, and also includes their assets such as farmland acreage, farmland ownership, production, farm location, and years of farming. In addition, the questionnaire also requested information about producers'

expected return on investment, the perception of non-monetary benefits from cooperative investment, ability to use the tax credit benefits, opinion about the VAP Cooperative marketing contract, the producers' perception of risk associated with the cooperative investment, and the producers' perceptions of fairness about how the cooperative treats its members.

Survey Design

This study examines the hypotheses from the theory by comparing wheat producer members of VAP Cooperative and non-members of VAP Cooperative in terms of the effects of demographic characteristics, non-monetary benefits, fairness, and investment risk on the investor's expected utility and their investment decisions. The VAP Cooperative is a new generation cooperative which has a more unique marketing/production contract than do traditional open cooperatives.

Data

The surveys are directed to members of Value Added Products Cooperative Association, a closed cooperative at Alva, Oklahoma and wheat growers who are non-members of VAP Cooperative. The survey instruments for the wheat producers allowed for comparison of the results between the two samples of wheat producers. The instrument allows comparison of qualitative and quantitative measures of the impact of non-monetary benefits and investment risk on the investor's expected utility and investment decisions in the agricultural cooperative.

Each of the 712 VAP Cooperative members was sent a questionnaire by mail. The names of these 712 producers were obtained from VAP Cooperative in Alva, Oklahoma. A random sample of 1500 non-members of VAP Cooperative was taken by the

Oklahoma Agricultural Statistics Service from its database (members were removed). Each randomly selected non-member also received a questionnaire by mail. Those who did not respond were sent a second questionnaire and received one telephone request to complete the questionnaire. One week after the first mailing of questionnaires, each of the wheat producers was sent a thank you postcard to thank them for their participation and to encourage them to respond if they had not returned the questionnaire.

The questionnaire was reviewed by a research project committee to ensure its accuracy and effectiveness. It was then approved by the VAP Board of Directors. The final version of the questionnaire consisted of 15 questions concerning producers' perceptions about their investment in VAP Cooperative. The questionnaire is in Appendix F.

The VAP Cooperative questionnaire starts with questions about the respondent's farmland location, the length of time they have operated a farm business, wheat production, farm acreage, land ownership, and some wheat marketing questions. A section focuses on the respondent's familiarity with VAP Cooperative and their method of learning about VAP Cooperative. Respondents were asked about their expected rate of return on their VAP investment compared to other debt or investment interest rates. Respondents indicate whether they are able to claim the Oklahoma Agricultural Producer income tax credit as a result of their VAP investment or investments similar to VAP. Then, respondents indicate whether or not they have off-farm employment. Respondents were also asked to agree or disagree with several statements about whether perceptions of fairness, non-monetary benefits, tax credit, risk, marketing contract, and transferability of VAP's share affected their investment decision. The last part of questionnaire includes

some questions on the respondents' demographic characteristics such as gender, age, and education level.

The questionnaire was first mailed on January 28, 2002. One week later, a thank you postcard was mailed to all respondents. On February 25, 2002 the second mailing of the questionnaire was sent out to those who did not respond in the first mailing. Finally, those who still did not respond received a phone call requesting completion of the questionnaire. Some of the respondents who were called requested a third mailing. Responses from 298 respondents who did not invest and 323 respondents who did invest in VAP Cooperative were received.

Factor Analysis

The survey of wheat producers produces a complex set of raw data for testing the hypotheses of the proposed model. Raw data consist of several sets of scores of N observations. A correlation exists between sets of scores that can be measured by the correlation matrix produced. The sets of scores that are recorded from question number 11 are grouped by their classification related to the variables in the model. All of the items in the question 11 can be classified into four categories: (1) items that measure fairness; (2) items that measure attitudes toward the marketing contract; (3) items that measure social benefits; (4) items that measure risk.

In order to simplify a complex set of data, factor analysis was used. Usually factor analysis is applied to the correlation matrix between a number of variables. Thus, factor analysis is designed to simplify large correlation matrices so that they can be explained in

terms of a few underlying factors. Essentially a factor is a construct operationally defined by its factor loadings[10] (Royce, 1963).

One of the types of factor analysis that is commonly used is principal component analysis. This type of analysis has simple algebra and computation techniques based on how the factors account for variance and explain correlations. The purpose of principal components analysis is to be able to estimate the correlation matrix, and this can be done by finding the characteristic equation of the matrix. This requires two sets of values, the characteristic vectors of the matrix or eigenvectors and the characteristic roots or eigenvalues. The eigenvector is a column of weights each applicable to one of the variables in the matrix. For example, if there are five variables there would be five weights in the first vector. The eigenvalue is the sum of squares of the factor loadings of each factor and reflects the proportion of variance explained by each factor. Thus, the larger the eigenvalue the more variance is explained by the factor. The principle method of eigenvalues and eigenvectors calculation is an iterative approach. A vector is tried and tested against a criterion set of values. To the extent that it diverges from the criterion, the first trial vector is modified to produce a second vector and so on until the solution converges.

Another method of factor analysis that has become popular in recent years is maximum likelihood factor analysis. Much of this originated from Joreskog in 1973. Maximum likelihood factor analysis differs from principal components analysis in terms of how variance is explained from the correlation matrix. Maximum likelihood factor analysis explains as much variance as possible in the *population* correlation matrix as

[10] Factor loadings are the correlations of a variable with a factor. Factor loadings can be obtained by multiplying each element of the eigenvector by the square root of the corresponding eigenvalue.

estimated from the sample correlation matrix. Thus, it must be separated from the principal components analysis that explains as much variance as possible in the *sample* matrix.

Maximum likelihood factor analysis, as a method of condensation, is expected to search for factors. The strongest argument for choosing maximum likelihood factor analysis lies in the fact that it has statistical tests for the significance of each factor as it is extracted.

However, Kline (1994) says that the non-statistical method for selecting the correct number of factors is highly efficient. He also noted that maximum likelihood factor analysis has become popular in recent years because of the development of some powerful multivariate statistical computer packages. The differences between those two methods are few, especially when test reliabilities and communalities[11] are high.

Significance of Factor Loadings

The most critical element is whether a factor loading is significant or not, regardless of what method of condensation is used. Normally, a factor loading of 0.3 indicates that 9 percent of the variance is accounted for by the factor. This is taken as a criterion to indicate that the loading is remarkable (Kline, 1994). This study regards a factor as a remarkable loading if the loading is above 0.3.

[11] Communality is the sum of squared of the factor loadings in each row of a factor matrix that indicates the proportion of variance in each variable which the factors can explain.

Procedure for Objective 2:

Comparable data from members and non-members of VAP Cooperative were merged into one data set. Maximum likelihood factor analysis and principal component procedures were used to simplify the data. The central idea of factor analysis is to reduce the dimensionality of a data set that consists of a large number of interrelated variables, while retaining as much as possible of the variation present in the data set. This is achieved by transforming to a new set of variables which are uncorrelated and ordered so that the first few factors retain most of the variation present in all of the original variables.

In principal component analysis, the analysis is performed by the *FACTOR* procedure in SAS. The following statements were used to obtain the results in the principal component analysis:

PROC FACTOR [options];
    VAR variables;
    RUN;

The *VAR* statement specifies the numeric variables to be analyzed. Several options were used following the *PROC FACTOR* statement. The *DATA*= option specifies the input data set to be used, the *OUT*= option creates a data set containing all the data from the *DATA*= plus variables called *FACTOR1*, *FACTOR2*, and so on, containing estimated factor scores. The maximum number of factors to be extracted and the amount of memory to be allocated for factor matrices were specified by *N*= option. To obtain the basic statistic results e.g. means, standard deviations, and the number of observations, the *SIMPLE* option was used, and the *CORR* and *EV* options produce the correlation matrix

and the eigenvectors. The output includes all the eigenvalues and the pattern matrix for eigenvalues greater than one.

Given the sets of scores from producers' responses with respect to question 11, items *a* through *s*, four social/non-monetary scores and five risk scores were available for analysis. The social data set contains the variables representing statements about: job creation in Alva is important (*JOB*), respondents knew people investing in VAP (*PIV*), respondents knew the people organizing VAP (*MKW*), and a statement about the respondents plans to attend the VAP annual meetings (*MTG*). The risk data set contains the variables representing statements about: VAP is a low-risk investment (*LRS*), the other investments are low risk (*OLR*), the probability of VAP success was greater than 90 percent (*SCS*), the probability of patronage refunds would be high (*PRH*), and shares in VAP will appreciate in value (*SAP*). The *PROC FACTOR* output begins with simple statistics, and the principal components are computed from the correlation matrix. The output also contains the table of eigenvalues of the correlation matrix, the eigenvectors matrix, and the factor pattern matrix[12]. The factor pattern matrix interprets what those factors represent. The *PROC FACTOR* output also produces the final communality estimates that explain the proportion of the variance of the variables accounted for by the factors. If the factor analysis produces more than one factor, a plot of a factor against the others can be displayed to determine the magnitude of variance between factors.

To produce better estimates in large samples, this study also used a maximum-likelihood method that has desirable asymptotic properties. This method provides a statistical test about the number of factors that are retained and used to represent the original data set. To do the maximum-likelihood method, the *METHOD=ML* option was

[12] The factor pattern matrix is the matrix of correlations between variables and the factors produced.

used. The output results in hypotheses testing based on the chi-square test. The combination of two methods in this factor analysis provides better results because the principal component analysis was first used to get a rough idea of the number of factors before doing the maximum-likelihood analysis.

Using the factors generated from the factor analysis, then the model is estimated using a Tobit procedure that is appropriate for the censored dependent variable. The independent variables are: expected return on investment, members' perception about non-monetary benefits generated by the cooperative investment, the risk associated with cooperative investment, members' perception about fair treatment delivered by the cooperative, experience with the cooperative marketing/production contract, years of farming, off-farm work hours, and awareness to the VAP Cooperative.

The censored regression model in this study is estimated using the method of maximum likelihood. This model has both discrete and continuous parts in its dependent variable (Johnston and DiNardo, 1997). Instead of observing the decision to invest in VAP Cooperative, the data on the amount of shares producers invested are observed. Thus, using the Tobit model the observed dependent variable is given by

$$\textbf{(32)} \qquad \begin{array}{ll} I_i = I_i^* & \text{for } I_i^* > 0 \\ I_i = 0 & \text{for } I_i^* \le 0 \end{array} \qquad \text{for } i = 1, \ldots, N$$

where I^* represents the amount of share units producers invested in the VAP Cooperative for those who joined the VAP Cooperative, and zero for those who did not join.

Based on the closed cooperative investment demand function (Equation 21) in Chapter 3 the estimated equation is:

$$\textbf{(33)} \quad \begin{aligned} I_i = {} & \alpha_1 + \alpha_2 DISTANCE_i + \alpha_3 YEAR_i + \alpha_4 FAMILIAR_i + \alpha_5 FAIR_i + \alpha_6 CONTRACT_i \\ & + \alpha_7 RISK1_i + \alpha_8 RISK2_i + \alpha_9 SOCIAL_i + \alpha_{10} RATE_i + \alpha_{11} WORK_i + \alpha_{12} TAX_i + \varepsilon_i \end{aligned}$$

for $i = 1, \ldots, N$

where $DISTANCE_i$ is the distance of respondent i's farm location from VAP Cooperative in miles. $YEAR_i$ is the number of years respondent i has farmed.

$FAMILIAR_i$ is the variable for respondent i's awareness of the VAP Cooperative ($FAMILIAR_i = -2$ if respondents are not familiar with the VAP Cooperative, -1 if respondents are less than moderately familiar, 0 if they are neither familiar or not, 1 if respondents are greater than moderately familiar, and 2 if respondents are highly familiar). $FAIR_i$ is the dummy variable representing the respondent's perception about fair treatment delivered by VAP Cooperative. This variable was measured by adding the scores provided by respondents according to the statements in items *e* and *n* (Table VII). $CONTRACT_i$ is the dummy variable representing the respondent's perception about VAP Cooperative marketing contract. This variable was measured by adding the scores provided by respondents according to the statements in items *o* and *p* (Table VII). By adding numerical scores, $FAIR_i$ and $CONTRACT_i$ variables were measured on a 2 to 10 scale.

$RISK1_i$ and $RISK2_i$ are the first-two factors retained from ML factor analysis that represent the respondent's perception about risk on VAP Cooperative investment (From the raw data set, score = 1 if respondents strongly disagree with statements in items *h*, *i*, *j*, *k* and *s* (Table VII), 2 if respondents disagree, 3 if respondents are uncertain, 4 if respondents agree, and 5 if respondents strongly agree).

$SOCIAL_i$ is the first factor retained from ML factor analysis that represents the respondent's perception that VAP Cooperative creates social/non-monetary benefits to

investors (employment in the local community). The social factor is also measured using scores provided by respondents according to the statements in items *a*, *b*, *f*, and *m*, Table VII; $RATE_i$ is the expected rate of return from VAP Cooperative investment for respondent *i*, which is measured from responses to Question 7 in the questionnaire ($RATE_i = 1$ if respondents need the rate of return to be greater than the local bank's rate on a Certificate of Deposit, 2 if respondents need the rate of return to be greater than the loan rate that they pay on land, 3 if respondents need the rate of return to be greater than the loan rate that they pay for production expenses, 4 if respondents need the rate of return to be greater than the rate that they pay for credit card debt). $WORK_i$ is the dummy variable for off-farm employment ($WORK_i = 1$ if respondent is working off-farm and 0 otherwise). TAX_i is the dummy variable for the Oklahoma Agricultural producer income tax credit ($TAX_i = -2$ if respondents strongly disagree with statements in item *d*, Table VII (Producers could take advantage of the 30% Oklahoma Agricultural Producer income tax credit), -1 if respondents disagree, 0 if they neither agree or disagree, 1 if respondents agree, and 2 if respondents strongly agree), and ε_i is the error term.

Results: Survey of Value Added Products Cooperative

Questionnaire results for members and non-members of VAP Cooperative are presented in this section. The factor analysis and Tobit model results follow.

Producer Characteristics

Producer characteristics for those who invested and those who did not invest in VAP Cooperative are shown in Table I.

Table I. General Descriptive Information about Respondents in Study

Characteristics	VAP Members	Non-Members
Gender:		
Male	78.46 %	96.23 %
Female	21.54 %	3.77 %
Education:		
Average	15.27 years	14.29 years
High school	19.55 %	35.32 %
College	55.77 %	49.81 %
Post Graduate	24.68 %	14.87 %
Average Age	56.86 years	58.16 years
Percentage of income from wheat	63.66 %	61.13 %
Averages:		
Farm acreage	1609.09 acres	1162.31 acres
Acres of wheat	620.67 acres	422.86 acres
Farmland was rented from others	34.77 %	38.87 %
Wheat production in 2000	18,015.68 bushels	10,507.40 bushels
Wheat production in 2001	16,717.32 bushels	9,348.57 bushels
Number of years farming:		
Average	30.65 years	31.43 years
More than 5 years	95.91 %	100.00 %
More than 10 years	88.05 %	93.21 %

Seventy-nine percent of the respondents that invested in VAP Cooperative were male while 96 percent were male that did not invest in VAP Cooperative. The mean for education level was very similar at around 15 years with 20 percent of the VAP members finishing high school, 56 percent finishing college, and 25 percent finishing postgraduate programs. Almost fifty percent of non-investors were college graduates, and 35 percent with only a high school education.

The mean ages were also very close for VAP members and non-VAP members at about 58 years. On average, the non-VAP members had been farming a little longer than the VAP members, 31.43 years and 30.65 years, respectively. All non-VAP members had been farming for more than 5 years and 93.21 percent of them more than 10 years, while a majority of VAP members (96 percent) had been farming for more than 5 years.

The mean farm acreage for VAP members was 1609.09 acres with 39 percent of those acres planted to wheat (620.67 acres) and non-VAP members having an average 1162.31 acres with 36 percent in wheat (422.86 acres). Those producers who invested in VAP Cooperative rented an average of 34.77 percent of their farmland. Those producers who did not invest in VAP Cooperative rented an average of 38.87 percent of their farmland. The significant difference is in the average bushels for each group. The VAP members produced an average of 18,015.68 bushels in 2000 and 16,717.32 bushels in 2001 while non-VAP members produced an average of 10,507.40 bushels in 2000 and 9,348.57 bushels in 2001. Wheat was clearly a more important crop for members. Most of the producers from both groups have most of their gross income from their farm business, 63.66 percent for VAP members and 61.13 percent for non-VAP members.

Familiarity with VAP Cooperative

Producers were asked to indicate how familiar they are with the VAP Cooperative and how they learned about the VAP Cooperative. Familiarity with VAP Cooperative is measured on a one to five scale, with a one being not familiar and five being highly familiar. Forty-three percent of producers that invested in VAP Cooperative were moderately familiar with VAP Cooperative while about 48 percent of non-VAP members were not familiar with VAP Cooperative (Table II).

Table II. Percentage of Familiarity with Value Added Products Cooperative

Level of familiarity	VAP Members (N=321)	Non-Members (N=280)
Not familiar	0.62 percent	47.50 percent
Less than moderately familiar	7.17 percent	22.14 percent
Moderately familiar	43.30 percent	21.07 percent
Greater than moderately familiar	25.86 percent	5.36 percent
Highly familiar	23.05 percent	3.93 percent

Figure 3 suggests that familiarity level is positively related to the size of investment. Each dot represents one respondent. On average, thirty-three percent of all sample respondents were moderately familiar with VAP Cooperative.

To find out how respondents learned about the VAP Cooperative, producers were asked to select the methods that they used to learn about VAP Cooperative. Respondents were offered five methods that producers would have used to learn about VAP Cooperative: (1) Attend a meeting where the prospectus for VAP was presented, (2) Read a magazine/newspaper article about VAP, (3) Saw television news report about VAP, (4) Discuss VAP with other farmers/producers, and (5) Others.

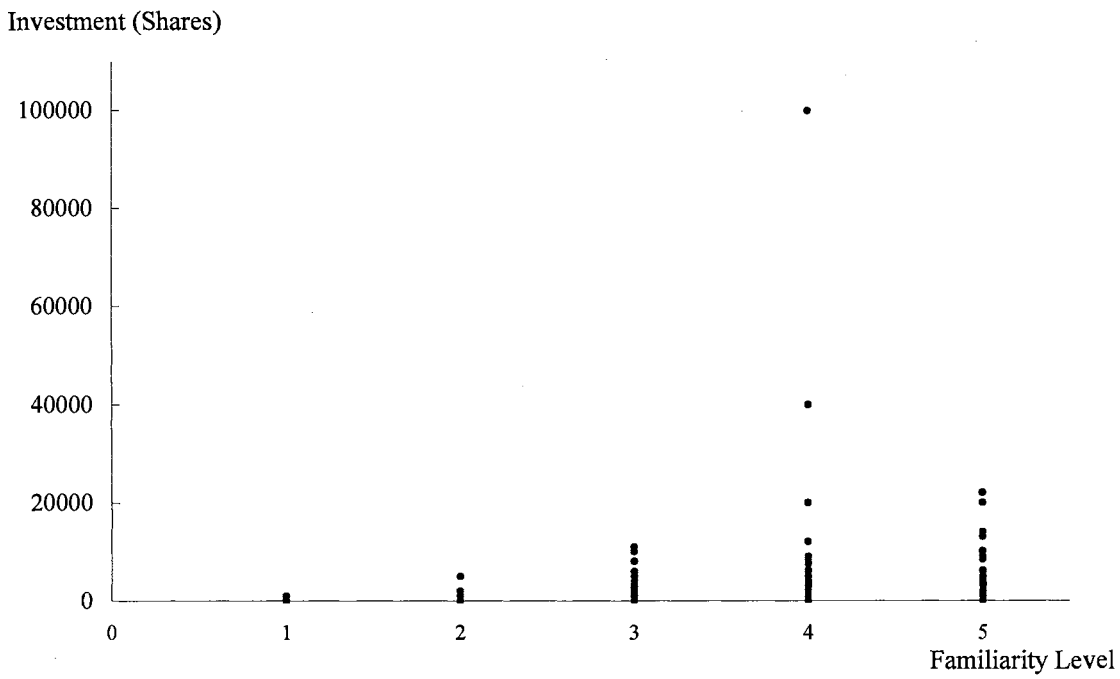

Figure 3: Investors' Familiarity with VAP Cooperative Investment Measure by Size of Investment

Table III shows the percentage of responses for each method of learning about VAP Cooperative. A majority of the investors (61.37 percent) learned about VAP Cooperative by attending a meeting where the prospectus for VAP was presented. Eighteen percent learned about VAP through discussion with other producers. About 12 percent of investors learned about VAP Cooperative from other sources. However, none of the investors learned about VAP from television news reports. Sixteen percent of investors learned about the VAP Cooperative by attending a meeting and discussion with other producers.

Reading magazine/newspaper articles about VAP is a majority response of non-VAP members (55.97 percent). Twenty-six percent of non-VAP members learned about VAP Cooperative from other sources. About 10 percent of non-VAP members used discussion as the method of learning about VAP. Less than 2 percent of non-investors learned about VAP Cooperative from a television news report. Clearly, these results show that VAP members actively attended a meeting because they feel as a part of the company and they intend to spend extra time monitoring their investment.

Table III. Percentage of Respondents' Method of Learning about VAP Cooperative

Method of Learning	VAP Members		Non-Members	
	Percentage of Responses	Number of Responses	Percentage of Responses	Number of Responses
Attend a meeting where the prospectus for VAP was presented	**61.37**	**197**	7.00	17
Read a magazine/ news-paper article about VAP	10.28	33	**55.97**	**136**
Saw television news report about VAP	0.00	0	1.23	3
Discuss with other farmers/ producers about VAP	17.45	56	9.88	24
Others	12.15	39	25.93	63

Required Rate of Return

Producers were asked to indicate the rate of return on VAP investment or an investment similar to VAP that would be required for VAP to be a good investment. Respondents' required rates were compared to four different rates: the local bank rate on a certificate of deposit, the loan rate paid on land, the loan rate paid for production expenses, and the rate paid for credit card debt. Results of the questionnaire are shown in Table IV.

Table IV. Percentage of Respondents' Required Rate of Return on VAP or an Investment Similar to VAP

Expectations	VAP Members		Non-Members	
	Percentage of Responses	Number of Responses	Percentage of Responses	Number of Responses
Greater than the local bank's rate on certificate of deposit	33.23	106	25.38	66
Greater than the loan rate that paid on land	13.79	44	15.38	40
Greater than the loan rate that paid for production expenses	**35.74**	**114**	**41.15**	**107**
Greater than the rate paid for credit card debt	17.24	55	18.08	47

A majority of producers who are members of VAP (36 percent) or non-members (41 percent) required the rate of return on VAP investment or an investment like VAP to be greater than the loan rate that they pay for production expenses. About thirty-three percent of the members and 25 percent of non-members thought that the rate of return would need to be greater than the local bank's rate on a certificate of deposit.

The VAP's Share Ownership

Producers were asked how many shares they had purchased when they joined. Share ownership is shown in Table V. Sixty-eight percent of VAP Member owned between 1,000 and 3,000 shares. About nineteen percent owned between 3,001 and 5,000 shares. Three producers owned more than 20,000 shares.

Table V. The Percentage of VAP Cooperative's share ownership

Amount of Shares	Percentage of Responses	Number of Responses
Between 1000 to 3000 shares	**68.03**	**217**
Between 3001 to 5000 shares	19.12	61
Between 5001 to 7000 shares	2.19	7
Between 7001 to 10000 shares	6.27	20
Between 10001 to 15000 shares	1.57	5
Between 15001 to 20000 shares	1.88	6
More than 20000 shares	0.94	3

Minimal VAP Cooperative's share ownership is 1000 shares.

Sources of Income

Producers and spouses were asked to indicate whether they had off-farm employment as a source of family income. The producers and spouses' sources of income are summarized in Table VI. Producers and spouses with off-farm employment were asked the average number of hours per week spent at off-farm jobs. Producers with sources of income coming from wheat production were the majority of responses, sixty-four percent for members and sixty-one percent for non-members. Thirty-six percent of members and 39 percent of non-members had income from off-farm employment. The percentage of spouses of non-members that worked off-farm is higher than for members (39 percent for members, and 49 percent for non-members). Note that members with off-farm employment worked 33 hours per week and their spouses had 37 hours per week of off-farm employment. The off-farm working hours for non-members and their spouses are similar to members.

Table VI. The Percentage of Respondent's Sources of Income

Sources of Income	VAP Members		Non-Members	
	Percentage of Responses	Number of Responses	Percentage of Responses	Number of Responses
Gross income coming from wheat production	63.66	205	61.13	173
Producers had off-farm employment	36.34	117	38.87	110
Spouses had off-farm employment	39.06	116	49.24	130

Investment Decision

Results related to producers' attitudes toward VAP investment decisions are summarized in Table VII. Producers were asked to indicate their agreement or disagreement with nineteen statements about non-monetary (social) benefits of VAP membership, fairness, marketing contracts, and perceptions of risk. Many of the results present interesting contrasts between members and non-members. Most VAP members indicate that VAP Cooperative creates non-monetary or social benefits (items *a*, *b*, *f*, and *m*, Table VII). Eighty-two percent of members and only 37 percent of non-members agreed that creating jobs in Alva is important for them. Fifty-four percent of members said that other people that they knew were investing in VAP. Seventy-three percent of the investors said that they knew the people organizing VAP Cooperative, and 62 percent of them agreed that they would attend the VAP annual meetings. However, fifty-four percent of non-members stated that other people that they knew were not investing. Sixty-one percent of them did not know the people organizing VAP, and around fifty-one percent would not attend the VAP annual meetings if they were members.

When asked about fairness issues such as treatment of VAP to the investor, and distribution of patronage refund, more than 50 percent of members believe that VAP's

treatment and its patronage distribution were fair. Of non-members, sixty-three percent perceived that producers were not sure investors would be treated fairly in VAP and a very significant amount (79 percent) of them were uncertain about fairness of patronage distribution (items *e* and *n*, Table VII).

Both members and non-members did not have a problem with marketing contracts. The facts showed that sixty-nine to 76 percent of members and more than 50 percent of non-members preferred marketing contracts (items *o* and *p*, Table VII).

The risks associated with VAP investment showed very interesting results. Thirty-seven percent of investors agreed that VAP Cooperative is a risky investment compared to an investment in farmland. Forty-one percent of members and over forty-eight percent of non-members thought that their other investments were high risk. A majority of non-members were not sure about risk associated with and VAP success in the future (items *h*, *i*, *j*, *k* and *s*, Table VII).

The Oklahoma Agricultural Producer Income Tax Credit

Investors' agreement toward the statement about whether or not they are able to take advantage of the 30 percent Oklahoma agricultural producer income tax credit apparently supports the investment hypothesis, as may be seen in Table VII, item *d*. Eighty-six percent of members said they could take advantage of the 30 percent Oklahoma Agricultural Producer income tax credit. Only forty-four percent of non-members agree and expected to be able to take advantage of an income tax credit if they invested. In addition, investors were asked to indicate what percentage of the tax credit was used. Eighty-four percent of VAP members said that they are able to use 81.89

Table VII. Members and Non-members' Attitude toward Statements about VAP Cooperative Investment Decisions

Statements	VAP Members, in %			Non-Members, in %		
	Disagree	Uncertain	Agree	Disagree	Uncertain	Agree
a. Creating jobs in Alva is important for me	10.53	7.89	**81.58**	28.99	34.30	**36.71**
b. Other people I know said they were investing in VAP	30.13	15.56	**54.30**	**53.54**	35.86	10.61
c. The business prospectus for VAP appeared logical	3.63	13.20	**83.17**	15.31	**51.53**	33.16
d. I could take advantage of the 30% Oklahoma Agricultural Producer income tax credit	6.56	7.54	**85.90**	16.84	38.78	**44.39**
e. Producers/investors in VAP will be treated fairly	3.64	27.15	**69.21**	8.21	**62.56**	29.23
f. The people organizing VAP were known to me	13.58	13.91	**72.52**	**60.82**	24.23	14.95
g. Shares in VAP can be bought and sold	23.51	33.11	**43.38**	12.76	**72.45**	14.80
h. The probability of patronage refunds would be high	9.60	33.77	**56.62**	18.46	**67.18**	14.36
i. VAP is a low-risk investment compared to investment in farmland	**36.96**	33.66	29.37	33.85	**54.36**	11.79
j. My other investments are low risk	**41.39**	23.84	34.77	**48.47**	15.31	36.22
k. The probability of VAP success was greater than 90%	15.89	40.07	**44.04**	30.41	**62.89**	6.70
l. Producers need to form cooperatives to increase their income	7.92	20.13	**71.95**	11.56	28.14	**60.30**
m. As an investor, I plan to attend the VAP annual meetings	8.94	29.47	**61.59**	**51.31**	42.93	5.76
n. The planned patronage distribution from VAP is fair	2.33	40.20	**57.48**	11.28	**78.97**	9.74
o. Marketing/production contracts are good for agriculture	6.60	17.82	**75.58**	11.62	33.84	**54.55**
p. Agric. Marketing coop are better if they have a marketing contract	4.32	26.91	**68.77**	11.73	35.71	**52.55**
q. Only agricultural producers are allowed to participate in the VAP Coop	12.87	17.82	**69.31**	14.80	**54.08**	31.12
r. Meeting wheat delivery requirements to VAP is relatively easy	1.66	7.28	**91.06**	19.80	**63.96**	16.24
s. Shares in VAP will appreciate in value	4.64	45.03	**50.33**	11.34	**77.84**	10.82

Strongly disagree and disagree are combined. Agree and strongly agree are combined.

percent of the tax credit, and around 15.58 percent of the members could not claim Oklahoma agricultural producer tax credit in 2000.

Result: Maximum-Likelihood Factor Analysis

The sets of scores obtained from item *a* to *s* (Table VII) provide respondents' perceptions about VAP Cooperative investment. Those scores were categorized into four categories for each of the 621 observations. Since each category is represented by more than one item, it is impossible to include all the items as variables in a regression model simultaneously. Factor analysis is used to summarize the scores in one or two dimensions.

Social/Non-monetary Factor

Identifying the number of factor(s) that best represents the social or non-monetary benefits is the first task. The eigenvalues indicate that one component provides an adequate summary of the data. One component, with eigenvalue 2.2721, accounts for 57 percent of the total variance and two components explaining 75 percent of the variance, as may be seen in Table VIII. Based on *NFACTOR* criterion, this analysis retains only one factor. The other basis that is commonly used to justify the number of factors that will be retained is the eigenvalues-greater-than-one rule.

Table VIII. The Eigenvalues of the Correlation Matrix for Social/Non-monetary Benefits Factors

Eigenvalue	Difference	Proportion	Cumulative
2.2721	1.5419	0.5680	0.5680
0.7302	0.1938	0.1826	0.7506
0.5364	0.0752	0.1341	0.8847
0.4613		0.1153	1.0000

The hypothesis testing related to the factor analysis of social or non-monetary benefits components are summarized in Table IX. The probability levels for the chi-square test are less than 0.0001 for the hypothesis of no common factors, and 0.1153 for one common factor. Therefore, the one-factor seems to be an adequate representation of these data.

Table IX. Hypothesis Testing for Searching the Number of Factors of Social/Non-monetary Benefits of VAP Cooperative in Alva

Test	DF	Chi-Square	Pr > ChiSq
H_0: No common factors H_A: At least one common factor	6	435.2270	< 0.0001
H_0: 1 factor is sufficient H_A: More factors are needed	2	4.3202	0.1153

The first factor is a measure of the overall social or non-monetary benefits factor since the first eigenvector shows approximately equal loadings on all variables. The first factor in Table X has large positive loadings for all four variables. The correlation with the statement 'VAP management are known to me', *MKW* (0.81743) is especially high.

Table X. The First Factor Pattern for Social/Non-monetary Benefits Variables

Variables	Description	Factor1
JOB	Creating jobs in Alva is important to me	0.77716
PIV	People that I know also invest in VAP	0.65032
MKW	VAP management are known to me	0.81743
MTG	I will attend the VAP annual meetings	0.75961

Figure 4 plots the size of investment and the first factor of social/non-monetary benefits variables. There is an apparent positive relationship between investment size and the social benefits measure.

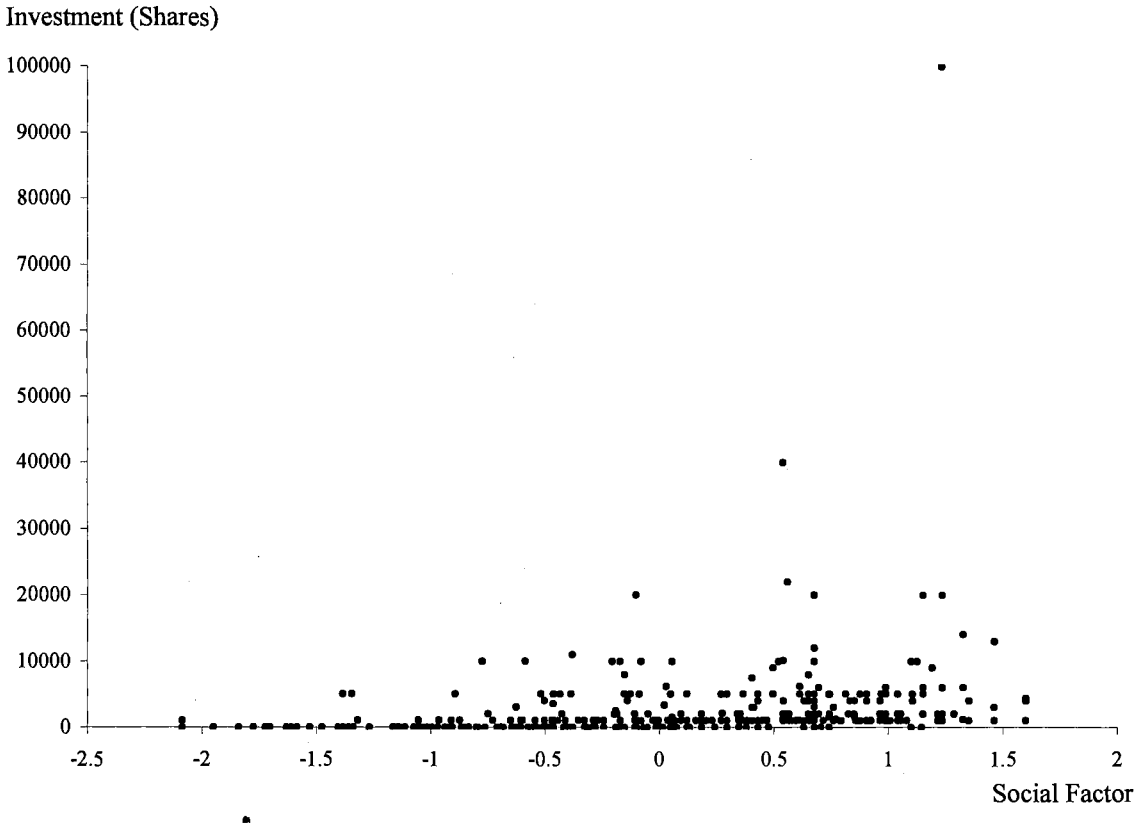

Figure 4: Investors' Perception about Social Benefits Measure by Size of Investment

Risk Factor

The analysis related to the risk associated with the VAP Cooperative investment shows that two components provide an adequate summary of the complex sets of risk variables. The eigenvalues of the correlation matrix for risk factors are presented in Table XI. Two components with large eigenvalues, 2.40652 and 0.96494, together account for 67 percent of the total variance. Two factors are retained based on the *NFACTOR* criterion. This analysis is confirmed by the hypothesis testing in maximum-likelihood factor analysis, as may be seen in Table XII. With the probability level of chi-square 0.7231, the hypothesis test failed to reject the second null hypothesis and provides support that the two-factor model is sufficient to represent five variables.

Table XI. The Eigenvalues of the Correlation Matrix for Risk Factors

Eigenvalue	Difference	Proportion	Cumulative
2.40652	1.44157	0.4813	0.4813
0.96494	0.28302	0.1930	0.6743
0.68193	0.14269	0.1364	0.8107
0.53923	0.13185	0.1078	0.9185
0.40738		0.0815	1.0000

The results in Table XIII provides factor patterns for the risk variables that shows the first factor is a measure of overall perception about risk associated with VAP Cooperative investment since the factor loadings and eigenvectors show approximately equal loadings on all variables. The second factor has high positive loadings on the variables *OLR* (Producers' other investments are low risk) and *LRS* (VAP is a low-risk investment compared to farmland), and high negative loadings on the variables *PRH* (The probability of patronage refunds would be high) and *SAP* (Shares in VAP will appreciate

in value). This second factor seems to measure the dominancy of investment financial risk perceptions over expectation of monetary benefits.

Table XII. Hypothesis Testing for Searching the Number of Factors of Risk Associated with VAP Cooperative Investment

Test	DF	Chi-Square	Pr > ChiSq
H_0: No common factors H_A: At least one common factor	15	515.8326	< 0.0001
H_0: 2 factors are sufficient H_A: More factors are needed	4	0.1255	0.7231

Figure 5 plots the size of investment as a function of investors' risk perception measures. There is an apparent positive relationship between investment size and the risk factor measure. Investors are willing to invest more if they perceive that VAP investment is low-risk, generates a high patronage refund, has a high probability of success, and VAP shares will appreciate in value.

Table XIII. The Factor Pattern for Risk Variables

Variables	Description	Factor1	Factor2
LRS	VAP is a low-risk investment compared to farmland	0.68897	0.15599
OLR	Producers' other investments are low risk	0.37220	0.87479
SCS	The probability of VAP success was greater than 90 percent	0.84430	0.00220
PRH	The probability of patronage refunds would be high	0.73035	-0.30590
SAP	Shares in VAP will appreciate in value	0.73963	-0.28597

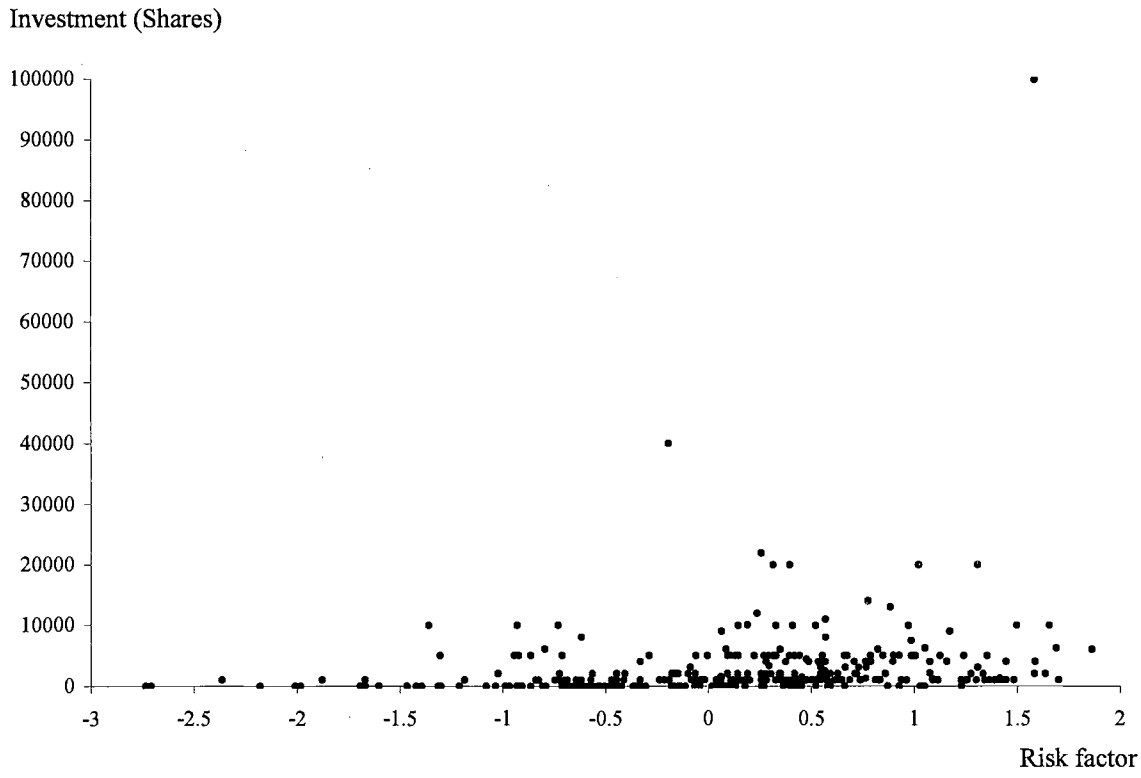

Figure 5: Investors' Perception about Risks Associate with VAP Cooperative Investment Measure by Size of Investment

In order to get the whole picture of the producers' perceptions, fairness and contract should be included in the model. Since producers' perceptions about fairness and marketing contracts in VAP are represented by two items from Table VII, items *e*, *n* (fairness) and *o*, *p* (marketing contract), the factor analyses are not used to simplify the variables. Producers' perceptions about fairness and marketing contracts in VAP were measured by adding the two numerical scores provided by respondents according to the statements from Table VII.

Result: Cooperative Investment Decisions

The results of the censored regression analysis in Table XV provide some support to the hypotheses from the proposed theoretical model of this study. Before the results are interpreted, the rationale for including those variables in the model and their expected signs is explained. Table XIV provides the expected signs and rationale for including the variables in the VAP Cooperative investment model.

The distance from Alva (*DISTANCE*) is included to indicate the evidence that the closer producers are to Alva, the more likely they are willing to invest. This variable is measured by taking the approximate shortest distance between Alva and the county seat of the county in which the producer is located. This measurement is provided by the Oklahoma Department of Transportation 1999-2000 Official State Map.

The variable used to indicate producers' experience in farm business is represented by *YEAR*. This variable measures the impact of years of farming on producers' willingness to invest in the VAP Cooperative. The hypothesis that older farmers may have no desire to change or to improve their current portfolio by investing in VAP Cooperative is tested.

Producers' familiarity with the VAP Cooperative is included to reflect how the producers' awareness of the VAP Cooperative in Alva influenced the propensity to join the VAP Cooperative. *FAMILIAR* is represented by Question 4 from the questionnaire.

Table XIV. Expected Signs and Rationale of Selected Variables for VAP Cooperative Investment Model

Selected Variables	Expected Sign	Rationale for including the variable
DISTANCE	-	Producers with farmland that is far away from Alva are likely to invest less VAP investment than producers with farmland closer to Alva.
YEAR	-	Older farmers may have no desire to change or improve their current portfolio.
FAMILIAR	+	Producers that are familiar with the VAP Cooperative may be more willing to invest in the VAP Cooperative.
FAIRNESS	+	Perception that producers in VAP will be treated fairly and VAP patronage distribution is fair would increase producers' willingness to invest in VAP.
CONTRACT	+	Producers that perceive that marketing/production contracts are good for agricultural marketing cooperatives will be more willing to contract with VAP as investors.
RISK1	+	Perception of VAP is a low-risk, high patronage refund, high probability of success, and shares will appreciate in value would increase producers' willingness to invest in VAP.
RISK2	-	Producers that prefer low financial risk for a given expected monetary return are less likely to invest in VAP Cooperative.
SOCIAL	+	The more producers perceive that VAP creates social/non-monetary benefits to investors, the more likely they are to invest in VAP Cooperative.
RATE	-	Producers that need higher rates of return from their portfolio may be less willing to invest in VAP Cooperative.
WORK	-	Producers working off-farm may have no extra time to spend monitoring their VAP investment and may less likely to invest in VAP Cooperative than full-time farmers.
TAX	+	Producers that are able to take advantage of the 30% Oklahoma Agriculture Producer income tax credit, are more willing to invest in VAP.

Variables to indicate fairness are shown as an agreement or disagreement with the following statements: "Producers/investors in VAP will be treated fairly", and "The planned patronage distribution from VAP is fair". Producers' perceptions about treatment and/or patronage distribution reflect the fairness factor in the censored regression model of VAP Cooperative investment.

The marketing contract is included in the model to indicate producers' perceptions about the influences of a marketing contract in an agricultural processing

operation like VAP Cooperative. Respondents' perceptions were measured by asking them to express agreement or disagreement with the two following statements related to the marketing contract: "Marketing/production contracts are good for agriculture", and "Agricultural marketing cooperatives are better if they have a marketing contract".

Perceptions that VAP is a low-risk investment, generates high patronage refund, has high probability of success, and its shares will appreciate in value are represented by two factors, *RISK1* and *RISK2*. Factor *RISK1* measures overall perception about risk associated with VAP Cooperative investment while factor *RISK2* measures the perception that predominantly emphasizes a low-financial risk over the expected monetary return from VAP Cooperative investment.

The hypothesis that producers are more likely to invest in VAP Cooperative if they perceive that VAP creates social/non-monetary benefits to investors, is indicated by the *SOCIAL* factor in the model. *SOCIAL* measures the overall perceptions about social/non-monetary benefits of VAP Cooperative by the investors.

The expected rate of return from VAP Cooperative investment (*RATE*) is included to indicate monetary benefits. This variable is measured by asking respondents to compare their needed rate of returns to the local bank's rate on certificate of deposit, the loan rate for land, the loan rate for production expenses, and the rate for credit card debt.

To indicate the effect of off-farm employment on producers' willingness to invest in VAP, the variable *WORK* is included in the analysis. This variable is obtained by asking respondents to indicate whether or not they have off-farm employment. Finally, *TAX* is included to reflect the Oklahoma Agricultural Producer income tax credit. This variable is expected to have a in a positive effect on VAP Cooperative investment

decisions. Respondents' perceptions toward statements about the advantage of the Oklahoma agricultural producer income tax credit was used to measure this variable.

Accordingly, the *LIFEREG* procedure in SAS was used to estimate the model. By default, the *LIFEREG* procedure computes initial values for the parameters using ordinary least squares ignoring censoring. However, this might not be the best set of starting values for a given set of data. The log-likelihood function is maximized by means of a ridge-stabilized Newton-Raphson algorithm. A composite chi-square test statistic is computed for each variable, testing whether there is any effect from any of the levels of the variable.

The amount of shares of the producers' investment varies considerably, with a minimum value of 1,000 shares and a maximum value of 100,000 shares. The mean producer investment is 3,589 shares with a standard deviation of 6,851.8. Results in Table XV show that among the explanatory variables, the number of shares producers invested in VAP Cooperative is positively related to *FAMILIAR* and *SOCIAL*. The familiarity measure is positive and significant at the one percent level. Producers who are familiar with VAP Cooperative are more likely to invest and invest more. The coefficient of the social and non-monetary benefits measure is also positive and significant at the one percent level. Clearly, the results suggest that VAP Cooperative should create the perception and the belief that the enterprise produces social benefits to investors. *RISK2*, which represents overall responses of producers that predominantly emphasizes on low-financial risk over the expected monetary return (risk averse) from VAP Cooperative investment, has a negative coefficient and is significant at the 10 percent level. Large

potential investors, who are risk averse, perceive that VAP Cooperative is a risky investment and will have less willingness to invest in VAP Cooperative.

Table XV. Parameter Estimate of the Cooperative Investment Decisions Using Censored Regression Model

Dependent Variables	Lower I_i	Left Censored Values	190
		Distribution	Normal
Number of Observations	486	Log Likelihood	-2985.546976
Noncensored Values	296		

Independent Variables	Parameter Estimate	Standard Errors
Constant	-119.478	1982.426
*DISTANCE***	-9.1412	3.5079
YEAR	-20.6991	15.4161
*FAMILIAR***	1525.417	244.2891
FAIRNESS	125.9939	238.9985
CONTRACT	41.5314	163.6396
RISK1	77.4709	198.3475
*RISK2**	-407.616	246.7011
*SOCIAL***	962.0520	245.4960
RATE	-6.3523	212.3705
*WORK**	-1072.84	528.4470
*TAX**	518.5784	257.4294

** Significant at the 1 percent level, * significant at the 5 percent level

The number of shares of investment is found to be negatively related to the distance from Alva (*DISTANCE*) and off-farm employment (*WORK*). The result suggests that the key to success for VAP Cooperative investment will be determined dominantly by more full-time local agricultural producers' support. The farther their farmland from Alva, the less likely producers will invest in VAP Cooperative. Potential investors are also more likely to be full-time farmers. The distance from Alva (*DISTANCE*) and off-farm employment (*WORK*) are significant at the one and five percent level, respectively.

Producers' experience in farm business (*YEAR*) and marketing contracts (*CONTRACT*) have the predicted sign but show no significant impact on VAP Cooperative investment decisions. Unless VAP marketing contracts change the perception and beliefs about marketing contract effectiveness they are not likely to influence investment decisions.

Fairness perception (*FAIRNESS*), overall perception about risk associated with VAP Cooperative investment (*RISK1*), and expected rate of return (*RATE*) show the predicted signs, but are not significant. Agreement with the statement that investors can take advantage of the Oklahoma Agricultural Producer income tax credit (*TAX*) shows a positive effect on the VAP Cooperative investment decisions. The income tax credit variable (*TAX*) is significant at the five percent level. Obviously, this result suggests that Oklahoma income tax credit was a factor in the investment decision. The value of tax refund is a function of the amount of investment that suggests the cooperative management should keep this government policy to ensure increasing producer investment.

Discussion

From the results of the VAP Cooperative investment decisions, it is apparent that the investors bear risks due to changes in the relative business environments that directly affect the VAP Cooperative as a new enterprise. However, many wheat producers in the Alva/Woods County area invested and became core investors in the VAP Cooperative. The empirical results give supporting evidence to explain this phenomenon. Regardless of the risks associated with VAP Cooperative investment, local agricultural producers in

Woods County invest because they believe that VAP Cooperative generates social benefits for the local community.

This analysis focused more specifically on the investor's membership decisions. Cook and Iliopoulos (2000) explored the impacts of property rights on the incentive for a producer to invest in the cooperative. Their results that suggest that the property rights structure of U.S. agricultural cooperatives significantly affects members' incentives to invest in their organizations. Cook and Iliopoulos distinguished among three types of cooperative investment problem in the U.S.: the existence of the free rider, horizon, and portfolio problems. The analysis of this study differs from theirs in a number of ways. They used the property rights structure in order to evaluate the differences between traditional and new generation cooperative, while this analysis uses investment theory to understand producers' willingness to invest in the new generation than the traditional cooperatives. Their analysis did not consider social/non-monetary benefits, the perception of risk, and the perception of fairness toward closed cooperative investment. This analysis is concerned with non-monetary factors that greatly affect producers' investment decisions. For their analysis, they developed hypotheses based on the cooperative investment problems and evaluate them based on the property rights, while this study develops and evaluates the hypotheses based on the basic microeconomic concepts about maximization of utility function.

The analysis in this study explicitly addresses the potential investor's choices regarding the investment decisions in order to better-understand the forces influencing the producer's investment decisions rather than looking at the property rights effects of the resulting investment. This is an important difference; the use of the investors'

perception measures rather than the property rights provides insights into the factors governing the investment decisions. Because perception reflects personal opinion it strongly affects behaviors and actions. By understanding the circumstances under which new generation cooperative investment is likely to be sufficient for a successful enterprise, investors are willing to support the existence of new generation cooperatives.

Using the evidence from producers' response toward social benefits, this study finds that a closed cooperative can be initiated and will survive if there is significant support from local producers concerned about social/non-monetary benefits.

Producers' responses clearly indicated that the VAP Cooperative is not viewed as a low-risk investment. Risk-averse investors are not as willing to invest in VAP Cooperative. Fairness did not impact producers' willingness to invest because cash patronage distribution in closed cooperatives was predetermined and should be agreed upon by each producer before the investment decisions were made.

Summary

The evidence examined in this chapter is, for the most part, consistent with the hypotheses developed in Chapter 3. The comparison of cooperative investment decisions between VAP members and non-members show that more explicit positive perceptions are required to convince people to make closed cooperative investments. The positive perceptions from local producers allowed the VAP Cooperative to exist and develop. VAP members clearly do not believe that VAP Cooperative was a low-risk investment as compared to investment in farmland.

Factor analysis was used to simplify large correlation matrices so that they could be explained in terms of a few underlying factors. The statistical tests under maximum

likelihood method are used to test for significance of each factor. One-factor is an adequate representation of the producer's perception about social/non-monetary benefits of VAP Cooperative, while perception about risk associated with VAP Cooperative investment is represented by two factors.

Econometric examination of producer investment decisions confirmed that social or non-monetary benefits have significant impacts on cooperative investment. Analysis demonstrated that a new generation cooperative needs strong support from local producers as core-investors to initiate and maintain the cooperative. Producers who are familiar with VAP Cooperative were willing to invest in VAP Cooperative, and producers with farmland far away from Alva are less likely to invest in VAP Cooperative. The preference for low-risk investment lowered producers' willingness to invest in VAP Cooperative. With regards to farm-employment status, full-time farmers show a greater intention to invest rather than did part-time farmers.

These results highlight some of the forces that determine producer's investment decisions. Differences in producers' decisions need to be recognized by closed cooperative management. The implications of these findings are discussed in Chapter 5.

CHAPTER V

CONCLUSIONS AND IMPLICATIONS

Throughout the United States, many traditional cooperatives are struggling to survive while new generation cooperatives are increasing in size and number. There is little research analyzing institutional changes, which suggests a need for theoretical models as well as empirical analysis of such changes. New generation cooperatives are growing rapidly without a sufficient theoretical basis. Agricultural producers need to know how to evaluate this investment before they determine whether or not to invest in the new generation cooperative.

The objectives of this study are to extend the theory of agricultural cooperatives by incorporating social/non-monetary benefits, investment risk, and fairness into the theory of coalition formation that influence producers' expected utility and investment portfolios that may include new generation cooperative investments. Hypotheses from the proposed theory are empirically tested.

Chapter 2 is a review of the basic model of coalition formation and previous research on coalitions and fairness. Chapter 3 developed new results in closed cooperative theory to examine the forces that influence producer's investment decisions in a closed cooperative. Chapter 4 then tested some of the hypotheses using data about actual agricultural cooperative membership decisions.

Result for Objective 1:

Objective 1 is to extend the theory of agricultural cooperatives by incorporating non-monetary benefits, the risk of investment, and fairness into the theory of coalition formation that influence producers' expected utility and investment decisions in new generation agricultural cooperatives. Investment theory is used to explain investment in new generation agricultural cooperatives. Further, the model utilizes the concept of a cooperative as a coalition in a framework of dynamic game theory. This dissertation does not use the observed data to measure the payoff configuration from the permissible coalition between the producers because the calculation is extremely difficult when there are thousands of potential participants. The model explains the development of an agricultural cooperative and provides criteria for evaluating closed cooperative investment decisions.

Theoretical results in Chapter 3 generated hypotheses about new generation agricultural cooperative investment. As a start-up enterprise, a closed cooperative investment is likely to be much more risky than many other investments. The rational investors will decide to invest if utility from a portfolio that contains a closed cooperative investment exceeds any other affordable portfolio. Closed cooperative investment theory predicts the demand for cooperative investment as a function of monetary return, social benefits, variance of the return, and fairness.

Chapter 3 uses closed cooperative theory to further predict that the supply function of cooperative investment is affected by purchased input from non-members, input from members, and investment capital, although this result was not empirically tested.

Result for Objective 2:

Objective 2 is to test whether hypotheses from the proposed theory are supported by empirical evidence about producers' expected utility and investment decisions in an agricultural cooperative. The empirical analysis in Chapter 4 support the hypotheses from Chapter 3. The results are consistent with predictions obtained from closed cooperative investment theory. The consistency of the empirical results with the theoretical predictions of Chapter 3 indicates that closed cooperative investment theory can offer insights into forces that greatly determine producers' investment decisions.

Based on the statistical tests using maximum likelihood factor analysis, one factor was considered an adequate representation of producer's perception about social/non-monetary benefits, and two factors were an adequate representation of perception about risk associated with VAP Cooperative investment. The factor that represents social/non-monetary benefits explains 57 percent of the variance in the correlation matrix. The first risk factor is a measure of overall perception about risk associated with VAP Cooperative investment, while the second factor measures the dominancy of financial risk perceptions over the expectation of monetary benefits.

The Tobit regression indicates that closed cooperative investment can be initiated and maintained: (1) if there is significant support from local producers, (2) if producers perceive that a closed cooperative provides social/non-monetary benefits, and (3) if it is a low-risk investment. Accordingly, the perception about fairness is not considered an essential determinant of producers investment decisions since the investor-cooperative relationship and patronage distribution were determined and should be agreed upon by both parties before contracts are signed. Chapter 4 clearly confirms that the lack of

publication and information related to VAP reduced the probability of investment, especially for producers who live further from the cooperative. VAP Cooperative investment is negatively related to producers' distance from Alva. Many non-members refused to provide their perceptions because of unfamiliarity with VAP Cooperative.

With regards to farm-employment status, VAP Cooperative investment is more likely for full-time farmers. The Oklahoma agricultural producer income tax credit is an important incentive for producers to invest in VAP Cooperative. However, not every VAP member knows that he/she can take advantage of the 30-percent Oklahoma agricultural producer income tax credit. Cooperative management should suggest that the Oklahoma legislature maintain this policy and even support federalizing it to encourage closed cooperative development in other states.

Lessons

While much more work remains to be done, particularly regarding further empirical evaluation of the new generation cooperative investment model, the existing analysis provides a number of lessons for participants in the closed cooperative dynamic game. The analysis in Chapters 3 and 4 provides insight into producers concern regarding participation in the closed cooperative membership. Producers' participation in closed cooperatives has an economic basis: risk, expected returns, and tax incentives are important factors influencing investment in new generation cooperatives. However, non-monetary benefits are also important.

Another lesson provided by closed cooperative theory is that it is important to understand the underlying forces and incentives motivating closed cooperative investment and their structures. The empirical results obtained from testing the

predictions of closed cooperative theory indicate that the necessary theoretical tools are available to agricultural economists to continue to explore the implications of closed cooperative investments for producers, cooperative managers, and government.

Implications

In addition to these lessons for investors in new generation cooperatives, the findings discussed in Chapter 3 and 4 suggest a number of wider implications. The nature of the new generation cooperative formation indicates a new criterion for maximizing the return on the investment of government funds in an agricultural cooperative, if the government decides it is socially desirable to promote new generation cooperative investment.

In addition, government support for this investment can affect cooperative management efforts to increase positive social perceptions about closed cooperative investments. Simply knowing about, attending the meeting or reading a magazine article about this investment does not appear to be enough to influence participation unless these activities influence producers' beliefs. Personal contacts with large producers would appear to be the best way that cooperative organizers and management can influence participation. People who are well known by a large number of producers and professionals in their fields are more likely to be able to attract investors. The empirical results show that producers' familiarity with their perception about social/non-monetary benefits are key factors in closed cooperative investment decisions.

Chapter 3 indicates that closed cooperative investment can be viewed as a dynamic game with perfect information between the cooperative and the producer. In the formation stage, the observed cooperative's behavior provides information to producers

to make decisions. The producers' perception with respect to the cooperative's behavior can conceivably change the producer's motivation to invest. Again, the cooperative manager can do something that will produce positive perceptions. In this stage, a cooperative's strategy is reflected by the business prospectus which greatly influences the success of the coalition formation.

Suggestions for Further Research

This study highlights one of the many questions raised by the analysis: is it possible to predict the cooperative-investors relationship when the cooperative is the concentration of the analysis? Related to this is another question: what are the key success factors that affect the supply of closed cooperative investment? What role does market power play in the dynamic game of closed cooperatives? Will it reduce or increase the incentives to invest for a given level of the marketing contract? These questions require further exploration. The ability of the extended theoretical framework to incorporate the observations of the development of the cooperative industry suggests that adapting the model to include such concerns may provide useful answers to these questions. This study may have limitations for application of the results since this is a case study of VAP Cooperative in Alva, Oklahoma that may or may not apply elsewhere.

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APPENDICES

OKLAHOMA AGRICULTURAL PRODUCER CREDIT

FORM 520 TAX YEAR 2001

For Oklahoma agricultural producers who invest in Oklahoma agricultural processing or marketing ventures. 68 O.S. Section 2357.25 and Rule 710:50-15-85

Name as shown on return (investor)	Social Security Number or Federal Identification Number

Provide the location(s) and the type of agricultural commodities being produced by the investor.

Name of the agricultural processing cooperative, venture or marketing association	Federal Employees Identification Number

Provide the location(s) and the type of agricultural commodities being produced, processed or marketed. Also provide a detailed description of activity.

CREDIT COMPUTATION

1. Total Amount of Direct Investment ..... $ _____
2. Rate 30%
3. Total Credit Allowable ..... $ _____
4. Amount of Credit Used in 2001 (carry to form 511CR) ... $ _____
5. Amount of Unused Credit ..... $ _____

CREDIT CARRYOVER-The credit not used may be carried over, in order, to each of the six (6) years following the year in which the investment was originally made. If any of the investment is sold or otherwise disposed of in a year prior to the credit being used, the credit, available for carryover, must be reduced. See below for computation.

TAX YEAR	2002	2003	2004	2005	2006	2007
Unused Credit from Previous Year						
Amount of Credit Used						
Unused Credit Available for Carryover						

DISPOSITION OF INVESTMENT

For the taxable year during which the investment, or any portion thereof is sold or otherwise disposed of, the amount of the credit allowed in prior years or being allowed in the current year shall be added to Federal Adjusted Gross Income to arrive at Oklahoma Adjusted Gross Income. Any unused carryover credit will be reduced to account for the sale or disposition.

		DOLLAR AMOUNT	
1. Total Amount of Original Investment 2001	1.		00
2. Less: Amount of Investment Sold or Disposed of	2.		00
3. Net Investment Remaining after Sale or Disposition	3.		00
4. Rate	4.	30%	
5. Revised Credit Allowable	5.		00
6. Less: Credit used in previous or current tax year(s) and not previously recaptured	6.		00
Subtract the amount on line 6 from the amount on line 5, if the result is a negative number enter amount on line 7. If the result is a positive number enter amount on line 8.			
7. Credit to be recaptured and included in income. Enter amount as a positive number on the other income or other additions line of the Oklahoma tax return.....	7.		00
8. Revised credit available for carryover to tax year _____	8.		00

APPENDIX B

AGRICULTURAL CREDIT - 68 O.S. SECTION 2357.25 AND RULE 710:50-15-85

There shall be allowed a credit for direct investments by Oklahoma agricultural producers in Oklahoma producer-owned agricultural processing cooperatives, ventures or marketing associations created and designed to develop and advance the production, processing, handling and marketing of agricultural commodities grown, made or manufactured in this state. The credit shall be thirty percent (30%) of the amount of the investment. If the credit allowed exceeds the tax liability, the amount of unused credit may be carried forward for a period not to exceed six (6) years.

The credit shall not be available or taken for any calendar year during which the claimant of the credit received any incentive payments pursuant to the Oklahoma Quality Jobs Program Act or the Saving Quality Jobs Act.

DEFINITIONS:

"Oklahoma agricultural producer" means any person who produces agricultural commodities in this state.

"Direct investment" means the payment of money in or the transfer of any form of economic value, whether tangible or intangible, other than money to an Oklahoma producer owned agricultural processing cooperative, venture or marketing association.

"Agricultural commodities" means a farm or ranch product, including but not limited to, wheat, corn, soybeans, cotton, timber, cattle, hogs, sheep, horses, poultry, animals of the families bovidae, cervidae and antilocapridae or birds of the ratite group produced in farming or ranching operations or a product of such crop or livestock in its unmanufactured state such as ginned cotton, wooldip, maple syrup, milk and eggs, or any other commodity listed under any Industry Group Number under Major Group 20 of Division D of the Standard Industrial Classification (SIC) Manual.

"Oklahoma producer-owned agricultural processing cooperative" means a legal entity, in the nature of a partnership or business, undertaking agricultural transactions or agricultural commercial enterprises for mutual profit. The entity must be controlled by the Oklahoma agricultural producers and a community of interest in the performance of the undertaking, transaction or enterprise; a right to direct and govern the policy in connection therewith; and the duty, which may be altered by agreement, to share both in profit and losses are required. The term does not include a cooperative that provides only, and nothing more than, storage, cleaning, or transportation of agricultural commodities.

"Oklahoma producer-owned agricultural processing venture" means a legal entity, in the nature of a corporation or company, organized to invest in or operate an agricultural commodity processing facility. The facility must be operated primarily for the processing or production of marketable products from agricultural commodities. The term shall include a dairy operation that requires a depreciable investment of at least two hundred fifty thousand dollars ($250,000) and which produces milk from dairy cows. The term does not include a venture that provides only, and nothing more than, storage, cleaning, or transportation of agricultural commodities.

"Oklahoma producer-owned agricultural processing marketing association" means a legal entity organized to jointly market agricultural commodities; facilitate the marketing process; and to promote and stimulate the processing, sales, and marketing of agricultural commodities. The term does not include a marketing association that provides only, and nothing more than, storage, cleaning, or transportation of agricultural commodities.

"Dairy operation" means and includes equipment and facilities to store and prepare feed, dairy cows, milking parlors, bulk cooling tanks, buildings, and all such depreciable investment commonly utilized in the dairy industry.

APPENDIX C

Oklahoma State University
Institutional Review Board

Protocol Expires: 11/29/02

Date: Friday, November 30, 2001 IRB Application No AG0216

Proposal Title: THEORY OF COOPERATIVE EVOLUTION

Principal
Investigator(s):

Dan Tilley
422 AG
Stillwater, OK 74078

Hubertus Puaha
422 Ag Hall
Stillwater, OK 74078

Reviewed and
Processed as: Exempt

Approval Status Recommended by Reviewer(s): Approved

Dear PI :

Your IRB application referenced above has been approved for one calendar year. Please make note of the expiration date indicated above. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval.
2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved projects are subject to monitoring by the IRB. If you have questions about the IRB procedures or need any assistance from the Board, please contact Sharon Bacher, the Executive Secretary to the IRB, in 203 Whitehurst (phone: 405-744-5700, sbacher@okstate.edu).

Sincerely,

Carol Olson

Carol Olson, Chair
Institutional Review Board

APPENDIX D

OKLAHOMA STATE UNIVERSITY

OSU

Division of Agricultural Sciences and Natural Resources
Department of Agricultural Economics
308 Agricultural Hall
Stillwater, Oklahoma 74078-6026
405-744-6157, 6154, 6081, 6086
Fax 405-744-8210 «MailingID»

January 24, 2002

«Company»
«FirstName» «LastName»
«Address»
«City», «State» «ZipCode»

Dear VAP investors,

As you know, Value Added Products is Oklahoma's first new generation cooperative. The purpose of this questionnaire is to provide a better understanding why you and others invested in a new generation agricultural cooperative like VAP. The success of new generation cooperatives is potentially important for many areas of Oklahoma.

The information you provide is strictly confidential. Summaries of the responses and data provided will be presented to the VAP Cooperative to help them evaluate business activities and respond to suggestions.

Should you have questions about this research, please contact Dr. Daniel S. Tilley, Professor (405-744-6156), Dr. Rodney B. Holcomb, Food Economist (405-744-6272), or Hubertus Puaha, Graduate Research Assistant in Agricultural Economics (405-744-6042). Please return the completed questionnaire in the attached postage paid envelope. Thank you for your participation.

Sincerely,

Daniel S. Tilley
Professor

Rodney B. Holcomb
Food Economist

Hubertus Puaha
Graduate Research Assistant

OSU

Division of Agricultural Sciences and Natural Resources
Department of Agricultural Economics
308 Agricultural Hall
Stillwater, Oklahoma 74078-6026
405-744-6157, 6154, 6081, 6086
Fax 405-744-8210

January 24, 2002

Dear wheat producers,

Oklahoma recently had its first new generation cooperative in Alva, Oklahoma. The purpose of this questionnaire is to provide a better understanding of why wheat producers do or do not invest in a new generation agricultural cooperative like Value Added Products (VAP) in Alva, Oklahoma. We hope to better understand the circumstances under which new generation cooperative business investment is likely to be sufficient for a successful enterprise.

The information you provide is strictly confidential and used only for research purposes. Should you have questions about this research, please contact Dr. Daniel S. Tilley, Professor (405-744-6156), Dr. Rodney B. Holcomb, Food Economist (405-744-6272), or Hubertus Puaha, Graduate Research Assistant in Agricultural Economics (405-744-6042). Please return the completed questionnaire in the attached postage paid envelope. Thank you for your participation.

Sincerely,

Daniel S. Tilley
Professor

Rodney B. Holcomb
Food Economist

Hubertus Puaha
Graduate Research Assistant

APPENDIX E

Script for Telephone Request to Complete the Questionnaire

Questionnaire No. _____

Name: _____ Interviewer: _____

Address: _____ Date Time

(Rural Route) 1st call _____ _____to_____

_____ 2nd call_____ _____to_____

(City) 3rd call _____ _____to_____

Phone: (_____) _____

Sex: (M) (F)

Hello Mr./Mrs. _____, I am _____ (state name) and I am working for Oklahoma State University at Stillwater. I am contacting you regarding to the mail survey that are conducted by the Department of Agricultural Economics, Oklahoma State University. This mail survey is used to collect the data for study on the development of new generation agricultural marketing cooperative in Oklahoma. Your participation in this survey is voluntary, and all information will be kept confidentially and used only for research purposes.

Did you receive the questionnaire that we sent to you?

___ Yes. Did you fill it out and return it in the attached postage paid envelope?

___ Yes (Stop). Thank you for your participation.

___ No. Would you let me asking you some questions related to that questionnaire?

(Note: If he/she agrees to answer the questions, continue to the questionnaire)

___ No. Would you let me asking you some questions related to that Questionnaire?

(Note: If he/she agree to answer the questions, continue to the questionnaire)

Otherwise,

Is that OK if we send the new one for you?

Is your mailing address still at _____? (Check the address).

___ No. What is your new mailing address?

_____

_____

___ Yes. (Stop). We really appreciate if you will fill it out and return it to us.

Thank you very much.

APPENDIX F

Value Added Products Cooperative Survey (Member)

1. a. In what county is your farm located? **(the majority)** _____

   b. How many years have you operated a farm? _____ years.

2. How many bushels of wheat did you produce/harvest in 2000 and 2001? _____ bushels in 2000, _____ bushels in 2001.

3. a. What is your total farm acreage? _____ acres.

   b. What percentage of the land you farmed in 2001 was rented from others? _____ %.

   c. How many acres of the crop land were used for wheat production in 2001? _____ acres.

   d. To what company/cooperative did you sell the largest portion of your wheat in 2001?

   Company/cooperative name _____

   Town _____

4. Please indicate how familiar you are with Value Added Products (VAP) Cooperative in Alva, Oklahoma? **(Put X inside [ ])**

Not Familiar	Less Than Moderately Familiar	Moderately Familiar	Greater Than Moderately Familiar	Highly Familiar
[ ]	[ ]	[ ]	[ ]	[ ]

5. How did you learn about VAP Cooperative in Alva, Oklahoma? **(Check all that apply)**.

   [ ] Attend a meeting where the prospectus for VAP was presented.
   [ ] Read a magazine/newspaper article about VAP.
   [ ] Saw television news report about VAP.
   [ ] Discuss with other farmers/producers about VAP.
   [ ] Others (please describe) _____

6. Do you own shares in VAP?

   [ ] Yes. If yes, how many? _____ shares.
   [ ] No

7. To be a good investment for you, the rate of return on your VAP investment would need to be: **(check all that apply)**

   [ ] Greater than the local bank's rate on CD's (Certificate of Deposit).
   [ ] Greater than the loan rate that I pay on land.
   [ ] Greater than the loan rate that I pay for production expenses.
   [ ] Greater than the rate I pay for credit card debt.

8. In 2000, were you able to claim the Oklahoma Agricultural Producer income tax credit as a result of your VAP investment?
   [ ] Yes. If yes, what percentage of the tax credit was used? _____ %.
   [ ] No

9. Do you have off-farm employment?
   [ ] Yes. Average number of hours employed off-farm ___hours/week.
   [ ] No

10. Does your spouse have off-farm employment?
   [ ] Yes. Average number of hours employed off-farm___ hours/week.
   [ ] No

11. To what extent do you agree or disagree with each of the following statements as they relate to your decision to invest or not to invest in VAP? (Place **the corresponding number** for each statement)
   Strongly Disagree – **1** Disagree – **2** Uncertain – **3** Agree – **4** Strongly Agree – **5**
   a. ____ Creating jobs in Alva, Oklahoma is important to me.
   b. ____ Other people I know said they were investing in VAP.
   c. ____ The business prospectus for VAP appeared logical.
   d. ____ I could take advantage of the 30% Oklahoma Agricultural Producer income tax credit.
   e. ____ Producers/investors in VAP will be treated fairly.
   f. ____ The people organizing VAP were known to me.
   g. ____ Shares in VAP can be bought and sold.
   h. ____ The probability of patronage refunds would be high.
   i. ____ VAP is a low-risk investment compared to investment in farmland.
   j. ____ My other investments are low risk.
   k. ____ The probability of VAP success was greater than 90 percent.
   l. ____ Producers need to form cooperatives to increase their income.
   m. ____ As an investor, I plan to attend the VAP annual meetings.
   n. ____ The planned patronage distribution from VAP is fair.
   o. ____ Marketing/production contracts are good for agriculture.
   p. ____ Agricultural marketing cooperatives are better if they have a marketing contract.
   q. ____ Only agricultural producers are allowed to participate in the VAP Cooperative.
   r. ____ Meeting wheat delivery requirements to VAP is relatively easy.
   s. ____ Shares in VAP will appreciate in value.

12. Gender: M___ F___

13. Age: _____

14. Education level: **(circle one of the number)**

Elementary	High School	College	Post Grad
1 2 3 4 5 6 7 8	**9 10 11 12**	**13 14 15 16**	**17 18 19 20+**

15. Do you have additional comments?

_____

_____

_____

Thank you for your participation in this survey.

Value Added Products Cooperative Survey (Non-member)

1. a. In what county is your farm located? (**the majority**) _____

   b. How many years have you operated a farm? _____ years.

2. How many bushels of wheat did you produce/harvest in 2000 and 2001? _____ bushels in 2000, _____ bushels in 2001.

3. a. What is your total farm acreage? _____ acres.

   b. What percentage of the land you farmed in 2001 was rented from others? _____ %.

   c. How many acres of the crop land were used for wheat production in 2001? _____ acres.

   d. To what company/cooperative did you sell the largest portion of your wheat in 2001?

   Company/cooperative name _____

   Town _____

4. Please indicate how familiar you are with Value Added Products (VAP) Cooperative in Alva, Oklahoma? (**Put X inside** [ ])

Not Familiar	Less Than Moderately Familiar	Moderately Familiar	Greater Than Moderately Familiar	Highly Familiar
[ ]	[ ]	[ ]	[ ]	[ ]

5. How did you learn about VAP Cooperative in Alva, Oklahoma? (**Check all that apply**).

   [ ] Attend a meeting where the prospectus for VAP was presented.
   [ ] Read a magazine/newspaper article about VAP.
   [ ] Saw television news report about VAP.
   [ ] Discuss with other farmers/producers about VAP.
   [ ] Others (please describe) _____

6. Do you own shares in VAP?

   [ ] Yes. If yes, how many? _____ shares.
   [ ] No

7. To be a good investment for you, the rate of return on an investment like VAP would need to be: (**check all that apply**)

   [ ] Greater than the local bank's rate on CD's (Certificate of Deposit).
   [ ] Greater than the loan rate that I pay on land.
   [ ] Greater than the loan rate that I pay for production expenses.
   [ ] Greater than the rate I pay for credit card debt.

8. In 2000, were you able to claim the Oklahoma Agricultural Producer income tax credit as a result of an investment in an agricultural processing operation?
   [ ] Yes. If yes, what percentage of the tax credit was used? _____ %.
   [ ] No

9. Do you have off-farm employment?
   [ ] Yes. Average number of hours employed off-farm ___hours/week.
   [ ] No

10. Does your spouse have off-farm employment?
   [ ] Yes. Average number of hours employed off-farm___ hours/week.
   [ ] No

11. To what extent do you agree or disagree with each of the following statements as they relate to your decision to invest or not to invest in VAP? (Place **the corresponding number** for each statement)

   Strongly Disagree – **1** Disagree – **2** Uncertain – **3** Agree – **4** Strongly Agree – **5**

   a. ____ Creating jobs in Alva, Oklahoma is important to me.
   b. ____ Other people I know said they were investing in VAP.
   c. ____ The business prospectus for VAP appeared logical.
   d. ____ I could take advantage of the 30% Oklahoma Agricultural Producer income tax credit.
   e. ____ Producers/investors in VAP will be treated fairly.
   f. ____ The people organizing VAP were known to me.
   g. ____ Shares in VAP can be bought and sold.
   h. ____ The probability of patronage refunds would be high.
   i. ____ VAP is a low-risk investment compared to investment in farmland.
   j. ____ My other investments are low risk.
   k. ____ The probability of VAP success was greater than 90 percent.
   l. ____ Producers need to form cooperatives to increase their income.
   m. ____ As an investor, I plan to attend the VAP annual meetings.
   n. ____ The planned patronage distribution from VAP is fair.
   o. ____ Marketing/production contracts are good for agriculture.
   p. ____ Agricultural marketing cooperatives are better if they have a marketing contract.
   q. ____ Only agricultural producers are allowed to participate in the VAP Cooperative.
   r. ____ Meeting wheat delivery requirements to VAP is relatively easy.
   s. ____ Shares in VAP will appreciate in value.

12. Gender: M___ F___
13. Age: _____

14. Education level: **(circle one of the number)**

Elementary	High School	College	Post Grad
1 2 3 4 5 6 7 8	**9 10 11 12**	**13 14 15 16**	**17 18 19 20+**

15. Do you have additional comments?

_____

_____

_____

Thank you for your participation in this survey.

VITA

Hubertus Puaha

Candidate for the Degree of

Doctor of Philosophy

Thesis: COALITION DEVELOPMENT IN THE AGRICULTURAL MARKETING SYSTEM

Major Field: Agricultural Economics

Biographical:

Personal Data: Born in Palembang, South of Sumatera, Indonesia, On October 24, 1965, the son of Petrus Kunadi and Ratnawati.

Education: Graduate from Mardi Yuana High School, Sukabumi, West Java, Indonesia in May 1984; received Bachelor of Science degree from Bogor Agricultural University, Bogor, Indonesia in October 1989. Received Master of Science degree in Management from Universitas Katholik Atma Jaya, Jakarta, Indonesia in October 1995. Completed the requirements for the Doctor of Philosophy degree with a major in Agricultural Economics at Oklahoma State University in August 2002.

Experience: Employed by Oklahoma State University, Department of Agricultural Economics as an Graduate Research Assistant, 2000 to present; employed as Graduate Teaching Assistant at Department of Agricultural Economics, Oklahoma State University, 1999 to 2000; employed as a lecturer at Department of Economics, University of Pelita Harapan, Jakarta, Indonesia, 1996 to 1997; employed as a lecturer and Vice Chairman for Academic Affairs at Sekolah Tinggi Ilmu Ekonomi Buddhi, Tangerang Indonesia, 1995 to 1997; and employed as an Experimental Animal Laboratory Supervisor at Shin Nippon Biomedical Laboratories Indonesia, 1991 to 1993.

Professional Memberships: Member of American Agricultural Economics Association, Western Agricultural Economics Association, Southern Agricultural Economics Association.