AN EMPIRICAL APPROACH TO EXPLORING THE ROLE OF SELECTIVE INCENTIVES IN MITIGATING THE FREE RIDER PROBLEM

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Doctor of Philosophy

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by

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The undersigned, appointed by the dean of the Graduate School, have examined the dissertation entitled:

AN EMPIRICAL APPROACH TO EXPLORING
THE ROLE OF SELECTIVE INCENTIVES
IN MITIGATING THE FREE RIDER PROBLEM

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a candidate for the degree of doctor of philosophy of Agricultural Economics, and hereby certify that, in their opinion, it is worthy of acceptance.

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ABSTRACT

This research study investigates free riding within large private collective action organizations and the role selective incentives may play in mitigating the free rider problem. A free rider generally refers to an individual who receives the benefits from group activities without bearing their appropriate share of the costs. Research efforts within the collective action area have identified and focused on the excludability of benefits as one of the key elements that enable individuals to free ride. If the benefits from group activities cannot be excluded, and are equally available to everyone, these benefits do not provide effective incentives to stimulate participation and reward resource contributions, usually described as voluntary financial contributions. Thus, individuals have an incentive to free ride on the contributions of others.

The organizational economics research area has also used the term free rider, but within a team production context. These research efforts have focused on the inability of a group to accurately measure the marginal contribution individual team members make towards the production of group benefits, as the key element that enables free riding to occur. If the marginal contributions of team members are difficult to accurately measure,

it is also difficult to design appropriate incentives to stimulate participation and reward resource contributions, usually described as human capital and individual effort.

Although these uses for the term free riding share a common foundation, they refer to different actions and/or behaviors by individual group members and are a result of different underlying conditions. This is the basis for the study's first research question which asks if there are multiple member free riding actions and/or behaviors that coexist within the large collective action organization analyzed.

Olson (1965) proposed three alternative solutions to the free rider problem within large collective action groups; they were coercion, a federated organizational structure and selective incentives. This study examines the role selective incentives play in mitigating a potential set of member free riding activities. It targets incentives created by the organization's by-laws and policies and builds upon the findings within the common pool resources research area. These previous studies indicate that groups have successfully created rules to assign property rights which mitigate free riding activities and enhance group benefits. Thus, the study's second research question asks if member free riding can be influenced by the by-laws and polices under the control of the collective action organization.

Two latent variable modeling techniques are used to analyze member survey data collected from a large agricultural marketing cooperative. A confirmatory factor analysis model is used to test for the coexistence of multiple free riding actions and/or behaviors. A structural equation model is then used to test for the relative influence the organization's by-laws and polices have on a set of free riding activities, given a set of alternative control variables.

The results from testing the first research question indicate there is a strong likelihood that multiple member free riding activities coexist within the organization analyzed. This suggests there is a tendency for individuals that free ride in one activity to also free ride in other activities that could enhance the provision of group benefits and help coordinate group activities. The results from testing the second research question indicate that the organization's by-laws and policies do influence member free riding activities, and are robust to a variety of alternative control variables.

These findings have implications for both researchers and leaders of collective action organizations. They suggest that member free riding activities within private collective action organizations may be more diverse and complex than previously described and that multiple actions and/or behaviors may need to be measured. The findings also suggest that the organization's members do evaluate the incentives created by the organization's by-laws and policies as part of their patronage decision. Thus, the organization may be able to utilize internal policy tools to create incentives which target problematic free riding activities.

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Chapter 1

Introduction

"Collective action arises when the efforts of two or more individuals are needed to accomplish an outcome. Activities that involve the furtherance of the interests or well-being of a group are often examples of collective action" Sandler (1992). Even though the potential exists to generate significant benefits from collective action and the actors agree on what should be done and how to accomplish the activity, it can be difficult to coordinate the actions of those who would benefit. Some collective action groups are able to form, coordinate group activities and create group benefits, while other groups are unable to form or form but then flounder and fail. The question of why some collective action groups succeed and others fail has been asked for centuries, and is still being asked today.

The phrase *the free rider problem* has been used to represent the challenges facing collective action groups. Hume (1740) is credited with providing the first explicit statement of the free rider problem;[1] "Two neighbours may agree to drain a meadow, which they possess in common; because 'tis easy for them to know each others mind; and each must perceive, that the immediate consequence of his failing in his part, is the abandoning the whole project. But 'tis very difficult, and indeed impossible, that a thousand persons shou'd agree in any such action; it being difficult for them to concert so complicated a design, and still more difficult for them to execute it; while each seeks a pretext to free himself of the trouble and expence, and wou'd lay the whole burden on others."

[1] See Laffont and Martimort (2002)

Hume's example illustrates two key characteristics of collective action problems. The first is how to coordinate the activities of the actors within the group and the second is how to entice the actors to provide resources toward group effort. For many years it was believed that groups of individuals which shared a common goal would naturally organize, either by establishing informal groups or creating formal organizations, to coordinate activities and pool resources to generate collective benefits. This commonly held viewpoint considered the motivation of the group to be the same as the motivation for an individual. If the benefits from group action were greater than the costs, a group would automatically be organized to accumulate the required resources and coordinate the activities of the actors. As a result, research efforts were focused on trying to determine why groups, which held the potential to generate considerable net benefits, were either not able to organize or if they did organize were not able to sustain their activities.

This viewpoint was challenged by Mancur Olson in his book *The Logic of Collective Action* (1965). Olson argued that "unless the number of individuals in a group is quite small, or unless there is coercion or some other special device to make individuals act in their common interests, *rational, self-interested individuals will not act to achieve their common or group interests*."

Olson argued that the key attribute which created collective action challenges was the inability to exclude collective benefits from those who did not participate in group activities. If the collective benefits could not be withheld and were equally available to everyone within the group, they could not be used as an incentive to reward participation in group action. Individual actors could receive the benefits from group action without

participating, so rational self interested individuals had no incentive to work towards achieving the group's goals. As a result, other incentives were needed to stimulate group participation. Olson went on to argue that group size was one of the key determinants of successful collective action. Small groups could use social incentives to align individual actions with group activities, while large groups would need to rely on coercion, a federated structure to keep sub-group size small or utilize other selective incentives to stimulate group participation.

Olson's propositions have stimulated a wide range of research activities that cut across social science disciplines and include economics, sociology, political science and anthropology. These propositions also dramatically shifted the research focus away from trying to understand why collective action groups did not form toward trying to understand how they were able to form and sustain activities. Along the way the phrase *free rider* or *free riding* become the term used to describe an individual who benefits from group activities without bearing the appropriate costs.

Finding solutions to free riding behavior and enhancing the level of group benefits has proven to be a daunting task. The collective action literature discusses two very general classes of solutions to overcome collective action problems and free riding behavior. The first is to try alter the nature of the attribute that enables free riding to occur. In the collective action area this means constructing alternative exclusion mechanisms. Club theory suggests that changes in technology may allow the use of physical exclusion mechanisms to limit access and restrict free riding. Examples include using barbed wire fence to exclude access to range land or electronic scramblers to limit access to digital communication. Researchers in the common pool resource area have

studied the use of institutional exclusion mechanisms to restrict access to shared or common resources. Resource users create and implement a set of rules that govern the use and appropriation of the shared resources.

The second general class of solutions focuses on creating alternative incentives to reward collaboration, punish non-collaboration or use a combination of both. As noted above, Olson suggested that small groups could use social incentives to reward and/or punish free riding, while large groups could bundle excludable benefits with the non-excludable group benefits as an incentive to reward collaboration or use coercion if possible. The common pool resource area has proposed that alternative bundles of property rights can create incentives for individuals to participate in group action and limit their appropriation of the shared resource.

The organizational economics literature has also discussed the challenges of coordinating group actions, in the context of team production. Alchian and Demstez (1972) argued that when it is difficult to measure the contributions of individuals within a team production setting team members have an incentive to shirk, or to avoid working. Their solution was to hire a monitor or manager to oversee the production process, give the manager the authority to expel non-productive team members and reward the manager with the residual benefits from the team production. As a result, the team members have an incentive to work harder and the manager has an incentive to monitor the team members. This is the basis for one of the theories of the firm.

Both of these research areas, collective action and organizational economics, discuss the challenges of coordinating group activities and stimulating group participation. Both also commonly use the term free riding or free rider to refer to

individuals who do not act in the group's common interest. However, the key attributes that create the conditions for free riding, the actions of the individuals that are described as free riding and the proposed solutions for free riding are discussed from different perspectives.

Testing the effectiveness of proposed solutions to free riding has proven to be as complex and challenging as identifying potential solutions. The key attributes that create challenges for collective action groups have also created challenges for researchers studying collective action problems. Group benefits that are difficult or impossible to exclude can also be very difficult to accurately measure. If a team has a difficult time measuring the contributions of individual team members and determining who is free riding, the researchers will have the same difficulty.

Because of these challenges, game theory and game experiments have been the most commonly used tools for studying and analyzing the challenges of coordinating group activity. These research efforts have made significant contributions towards enhancing our understanding of the role that game rules, player strategies and player payoffs can perform in improving group coordination. However, validating these findings in real world settings remains problematic, especially for large groups.

So, if the objective of a collective action group is to reduce free riding behavior to enhance group benefits, how does one describe and measure free riding? Are there tools or strategies that the group or organization can implement to create incentives and influence free riding behavior? The objective of this study is to inform these two questions.

The focus of this study is on free riding within existing private collective action organizations and will not address the issues involved in forming the organization. The organization's members, as the key decision makers, are the unit of measure, while the collective action organization is the unit of analysis. It is assumed that the organization's members are self interested actors that are attempting to maximize their individual net benefits.

The background and reporting for this study is divided into six additional chapters. Chapter 2 provides a review of the relevant theory used to support the research questions. Chapter 3 describes the research questions and presents the hypotheses that will be tested. Chapter 4 describes and discusses the collective action organization used as the unit of analysis. Chapter 5 discusses the research method and the survey used for primary data collection. Chapter 6 presents the latent variable models used to test the research hypotheses and discusses the analysis results. Chapter 7 discusses the implications of the research findings and presents suggestions for future research efforts.

Chapter 2
Review of Theory

Debates concerning the challenges facing groups attempting to organize and create collective benefits can be found in a wide range of academic disciplines which include economics, sociology, political science and anthropology. Even though the emphasis, approaches and underlying assumptions may vary across these disciplines, the objective is consistent; to determine and articulate the basis of the problems and then to propose and test the effectiveness of alternative solutions. A complete review of the literature on collective action and group coordination issues is beyond the scope of this study. However, an overview of key theoretical proposals is necessary to provide a foundation for the hypotheses being tested within this study. This chapter provides that overview.

2.1. Review of *The Logic of Collective Action*

The basis for much of the present day study of collective action can be traced to Mancur Olson's *Logic of Collective Action* (1965). Olson challenged the prevailing paradigm that groups behaved like individuals and would organize to create collective benefits when the need arose. He introduced two core propositions. First, group size had a great impact on a group's ability to organize and provide collective goods, thus large and small groups function differently. And second, it was rational for individuals within large groups to lack the ability to organize and provide collective goods, even though the group and its members would gain from group action.

2.1.1. Impact of group size:

Olson's first proposition was that group size heavily influenced a group's ability to organize and provide a collective good. He argued that *privileged groups* had the greatest ability to provide these goods. A privileged group was defined as "a group such that each of its members, or at least some one of them, has an incentive to see that the collective good is provided, even if he has to bear the full burden of providing it himself." Privileged groups were almost always small in size and the terms *small group* and *privileged group* were often used interchangeably. He argued that members in a small group each receive a substantial portion of the total value created by the group. So, even though gains are shared by everyone within the group, the *individual* has an incentive to contribute resources towards producing the collective good because a large portion of the total value is still available to that individual. And, if one of the group members were to reduce their resource contributions, the reduction in total group benefit would be easily noticed by other group members. Thus, there was a high probability that small groups would have the ability to collaborate and provide collective goods.

In contrast, a *latent group* was defined as a group where 1) each individual within the group received a small portion of the total group benefit, which provided little incentive for them to work towards enhancing group objectives, 2) each individual had a small impact on the total provision of the collective good so an individual who stopped contributing did not significantly reduce the total supply of aggregate group benefits and 3) latent groups had a strong tendency to be large, thus the initial organizational costs were higher because of the increased effort required to coordinate a large group. As a

result, there was a low probability that large groups could organize and provide collective goods. Once again, Olson commonly used the terms *latent group* and *large group* interchangeably.

A third group, termed an *intermediate group*, fell in between the latent and privileged groups. These were groups where no single group member had an individual benefit great enough to supply the good alone, but the group was small enough that members could correlate a reduction in total group benefits to a reduction in an individual's resource contribution. Olson argued that one could not *a priori* determine if an intermediate group would be able to organize and create collective goods.

One commonly cited portion of Olson's presentation on the differences between large and small groups is his discussion of member heterogeneity within small groups. Olson pointed out that "In small groups with common interests there is accordingly *a surprising tendency for the 'exploitation' of the great by the small*." Olson noted that not all members within a group share proportionally in the costs of providing collective goods. As a result, there is a tendency for the "small" members, who would realize smaller gains from group action, to contribute proportionately less than the "large" members, who would realize the greatest gain from group action.

2.1.2. Rational behavior within large groups:

Olson used the terms *collective good* and *public good* interchangeably and focused on the inability of a group to exclude the benefits of collective action as a link to the existing economic literature in public finance[2]. Olson proposed expanding the discussion of public goods beyond those provided by governments to include goods and

[2] This study will use these terms to represent separate, but related concepts.

services provided by private organizations, which exhibited the same attributes as public goods.

Olson defined a collective good as "any good such that, if any person X_i, in a group, $X_1,\ldots,X_i,\ldots,X_n$ consumes it, it cannot feasibly be withheld from the others in that group." Using this definition, once a collective good was created everyone within the group had equal access to the benefits, whether they contribute resources towards providing the collective good or not.

Olson maintained the traditional economic assumption that individuals act in their own best interests. Therefore, even though the members of a group have an interest in banding together to create collective benefits, there is no incentive for them to share the cost of providing the common good. Thus, even if a collective action group were able to overcome the initial organizational issues, it would be difficult to sustain these activities and there would be a systematic tendency for the group to under supply the desired level of collective good. This behavior later became known as *free riding*.

2.1.3. Mobilizing latent groups:

Olson introduced three potential solutions for the challenges facing latent groups supplying collective goods. They were 1) coercion, 2) a federated structure and 3) selective incentives. Coercion referred to a required, or mandated, resource contribution usually authorized and enforced by a government law or regulation; although coercion by the organization may also be possible. A federated structure referred to a large organization consisting of many small sub-groups or sub-organizations. Thus the smaller sub-group could maintain the advantages of a privileged or intermediate group, while still capturing many of the economies of scale available to a large group. A selective

incentive, as described by Olson, was "an incentive that operates, not indiscriminately, like the collective good, upon the group as a whole, but rather *selectively* toward the individuals in the group. The incentive must be 'selective' so that those who do not join the organization working for the group's interest can be treated differently from those who do. These 'selective incentives' can be either negative or positive, in that they can either coerce by punishing those who fail to bear an allocated share of the costs of the group action, or they can be positive inducements offered to those who act in the group interest." In a related footnote (fn. 71, pg. 51), Olson indicated that at times it can be difficult to distinguish between coercion and negative selective incentives. A more complete discussion of selective incentives is included in Chapter 3.

2.1.4. Inclusive versus exclusive groups:

Olson also proposed that groups can respond differently to the addition of new members. He differentiated an *inclusive* group from an *exclusive* group. An inclusive group encouraged participation by new members because the group would be able to increase the provision level of the collective good and/or reduce the membership costs. An exclusive group was one where the group benefit had a limited supply, so the inclusion of a new group member would result in reduced group benefits.

2.2. Advances Since *The Logic of Collective Action*

Olson's propositions stimulated a range of rebukes, rebuttals and research studies across a variety of social science disciplines, with the group size hypothesis and the rational behavior of group members drawing the greatest attention[3]. Within the economics literature on collective action, the group size hypothesis has been the primary

[3] See Udehn (1993) for an overview of research findings testing Olson's major propositions.

focus. The general findings regarding group size are inconsistent indicating that although group size can influence group action other variables are also impacting collective activities. This section outlines several advances in collective action theory that have occurred since the publication of Olson's work.

2.2.1. Alternative Classes of Collective Goods

Ostrom (2003) indicated that one of Olson's primary objectives within *The Logic of Collective Action* was to identify a single theory to explain the behavior of groups providing collective goods. And, that Olson was influenced by the preceding debate between Dr. Paul Samuelson and Dr. Richard Musgrave concerning the distinction between public and private goods, and the need for non-market institutions to provide different types of public goods. Samuelson (1954) focused on the consumption attributes of the good and identified a public good as one which had *jointness of consumption*. Or, one individual's consumption of the good did not significantly reduce the amount that was available to others. Some authors have used the term *non-rivalrous consumption* rather than jointness of consumption. Musgrave (1959) also focused on a good's consumption attributes, but identified a public good as one where it was infeasible to exclude someone from accessing the benefits created by the collective good. Olson chose to follow Musgrave's definition of public goods within his presentation and focused on the non-excludability attribute.[4]

However, Ostrom argued that theoretical and empirical research stimulated by Olson's work has identified four broad classes of goods. And, that by combining Samuelson's and Musgrave's definitions, one can gain a more complete understanding of these different classes. Table 1 presents an overview of the classifications resulting from

[4] see Olson, footnote 21 on page 14.

combining these definitions. (Ostrom & Ostrom 1977, Ostrom, Gardner and Walker 1994 and Ostrom 2003)[5]

Based upon the combined definitions, Cell D of Table 1 represents the general category for pure public goods, where it is not feasible to exclude consumption benefits and consumption by one individual does not subtract from the total amount of good available, or exhibits jointness of consumption. In contrast, a private good, represented by Cell A, is one where it is economically feasible to exclude individuals from consuming the good and consumption subtracts from the total available to others.

Table 1: Classification of Goods by Consumption Characteristics

	Samuelson's Classification (1954)	
Musgrave's Classification (1959)	One person's consumption subtracts from total available to others	One person's consumption does not subtract from total available to others *(Jointness of Consumption)*
Exclusion is Feasible	***Cell A***	***Cell B***
Exclusion is Not Feasible	***Cell C***	***Cell D***

Ostrom, Elinor (2003) 'How Types of Goods and Property Rights Jointly Affect Collective Action', *Journal of Theoretical Politics* 15(3): 239-270

Club goods or toll goods, represented in Cell B, and common pool resources, represented by Cell C, are described as hybrid goods or impure public goods because they possess some of the attributes of private goods and some of the attributes of public goods.

Club goods (Cell B) maintain the public goods attribute of jointness of consumption, but it is economically feasible to exclude consumption. As Cornes and

[5] It should be noted that Head (1962) was the fist to discuss the possibility that public goods exhibited both jointness of consumption and non-excludability. And, that both traits may be important for understanding the differences between public and private goods. However, he did not attempt to derive a classification system.

Sandler (1996) explain, "The essential difference between club goods and pure public goods depend on the existence of an exclusion mechanism, which establishes a pseudo-marketing device to overcome preference-revelation problems. With technological advances, exclusion may be invented for some pure public goods, thus transforming them into club goods." Ostrom (2003) provided a similar explanation of club goods but also included "the existence and enforcement of various bundles of property rights", extending the possible exclusion mechanisms beyond the typically listed physical exclusion examples.

In contrast, it is exceptionally expensive or infeasible to exclude individuals from consuming common-pool resources and consumption does reduce the amount that is available for others. Common-pool resources (CPR) are often plagued by excessive consumption leading to "the tragedy of the commons". Ostrom, et.al. (2002) describe common pool resources; "In this view, a *common-pool resource* is a valued natural or human-made resource or facility that is available to more than one person and subject to degradation as a result of overuse. Common-pool resources are ones for which exclusion for the resource is costly and one person's use subtracts from what is available to others."

Although the distinctions between public goods, club goods and common pool resources are still very general, they do highlight the belief that there is no single class of collective goods, but rather a group or family of goods. And, that each class has different attributes which can affect a group's ability to impact and monitor provision of collective goods, as well as influence an individual's actions. These concepts will be expanded upon below.

2.2.2. Influence of Production and Allocation Functions:

Olson combined a linear production relationship, between group resource contribution and total group output, and a classical *U* shaped cost function to illustrate how an individual's incentives to contribute towards group activities change as the group's size increases. Marwell and Oliver (1993) present a summary of research work which challenges the use of a linear production relationship as a general representation of collective action activities and discuss how alternative production relationships can influence individual incentives to participate in group action. Six alternative production relationships were outlined; 1) linear, 2) step, 3) quadratic, 4) concave, 5) convex, and 6) *S* shaped (ex. cubic).

Hardin (1976) discussed a step function, which requires that a minimum level of total resource contribution be reached before any collective output can be provided. This function creates what has been termed an *assurance problem* rather than the more traditional collective action problem discussed by Olson. If the minimum cumulative contribution level is not reached, no one within the group receives any benefits. Thus the marginal contribution of an additional member can make the difference between provision and non-provision, and creates an incentive for group participation.

Marwell and Oliver go on to argue that other production relationships can also influence the ability of a group to organize and provide collective goods. They contend that the concave production relationship, like the step function, is also conducive to overcoming initial collective action formation challenges. At low resource contribution levels the marginal contribution of an additional member can result in a significant increase in group output, thus providing an incentive to participate in the early stages of

group activities[6]. In contrast, the convex production relationship can create "positive interdependence" as each additional member's contributions compounds group output, once the challenges of the initial production stages have been overcome.

Thus, the shape of the production function determines the change in group output resulting from a marginal change in resource contribution. A large change in group output from additional resource contributions may create the incentive needed for individuals to participate in collective action activities. A large change in group output also makes it easier for other group members to detect changes in contribution levels. This resembles Olson's discussion of actions within intermediate and privileged groups. However, these actions are a result of the shape of the production function rather than the group's size.

Ostrom (2003) extends Marwell and Oliver's presentation by integrating the roll of the production function with an *allocation function*. An allocation function "assigns individuals a share of the total benefits or the total costs" of collective action. Ostrom argues that an allocation function becomes important when collective goods with impure public goods attributes are being produced. Within these situations, both the production function and the allocation function become relevant. The generalized function presented is:

[6] Marwell and Oliver assume that individuals make voluntary contributions to group activities sequentially and have knowledge of previous member's contributions.

$$U_i = U_i[(E - x_i) + A \bullet P(Ex_i)]$$

- U_i = the utility of the i^{th} person.

- E = the individual endowment or assets.

- x_i = the amount contributed.

- A = the allocation function.

- $P(Ex_i) = TG$ = the production function that determines the total amount of the collective good.

Thus, when a group has the ability to influence the allocation of costs and/or benefits among group members, the production relationship can be combined with alternative property rights and allocation rules as a method to influence participation and overcome collective action problems. Ostrom points to findings from field studies that have identified three commonly used allocation methods in CPR situations; 1) the value of assets held, 2) the seniority of claims and 3) special or temporal formula.

This discussion is consistent with Olson's general description of selective incentives, where incentives are created to target individuals, or sub-groups of individuals, to influence their participation in the group. Thus, the use of alternative property rights configurations and allocation rules may be used to mitigate free riding behavior, and is a central theme within the CPR literature.

2.2.3. Contributions from Game Theory and Experiments:

Game theory has become the most often used technique to study the problems facing collective action groups, with the two person *prisoner's dilemma game* being used as a starting point. Although the two person prisoner's dilemma game does not formally model the behavior described by Olson, it does illustrate how individuals pursuing their

own interests can achieve outcomes that are sub-optimal when evaluated at the group level.

Once again, there is an extensive literature in game theory and game experiments studying alternative representations of collective action, both social dilemmas and commons dilemmas. Kollock (1998) provides a review of game theory and experimental literature focusing on social dilemmas and emphasizing the three most common game structures used to represent these situations; the prisoner's dilemma game, the assurance game and the chicken game.[7] Kollock also classifies the potential solutions for social dilemmas, identified from these studies, into three broad categories; motivational solutions, strategic solutions and structural solutions.

Motivational solutions include three sub-categories; social value orientation, communication and group identity. Social value orientation refers to changing the assumption that "actors are not completely egoistic and so give some weight to the outcomes of their partners." Alternative motivations include maximizing joint outcomes, maximizing the relative difference between each player's outcomes and maximizing the partner's outcome with no regard for their own payoffs. If the player's motivation is not completely egoistic, a game's Nash equilibrium will change. Communication has been found to be a very robust approach to improving group coordination. Communication allows players to collect information about the alternative game outcomes, collect information about other player's strategies, allows the opportunity for "moral suasion" and may create or reinforce a sense of group identity. Group identity refers to a player being associated with a class or distinct group of players and this association alters their

[7] Heckathorn (1996) adds the altruist's game and the privileged game to the list of game structures that are used to represent collective action situations.

game strategy. Group identity has also been found to be a strong motivational factor even when communication is not allowed.

The strategic solutions include reciprocity, choice of partners, grim triggers, social learning and group reciprocity. Reciprocity refers to the strength of the 'Tit-for-Tat' strategy to sustain cooperation in an infinitely repeated prisoner's dilemma game, and was analyzed by Axelrod (1984). The choice of partners strategy is a variation on the 'Tit-for-Tat' strategy where a player exits the prisoner's dilemma game if the other player defects, and is called the 'Out-for-Tat' strategy. This strategy indicates that the choice of players within the game can also be important to gaining and maintaining collaboration. The grim triggers strategy has been applied to *N*-person social dilemmas where each player agrees to cooperate only if all other players cooperate. Experimental work indicates that players are uncomfortably adopting this risky strategy. Social learning models have also been applied to *N*-person dilemmas and assume "reward-seeking, penalty-averse actors" who search for collaborative thresholds and tend to follow other group members, rather than search for dominating strategies. And finally group reciprocity. Experiments have found there is a tendency for groups of players to establish and maintain a level of reciprocity within the group which increases cooperation.

The structural solutions introduce changes to the rules of the game, and include iteration/identifiability, payoff structure, efficacy, group size, and sanctions. The iteration/identifiablility solution encourages frequent and consistent interaction of identifiable players with traceable actions. This allows players to establish a "reputation" and makes it easier to establish the strategic solutions discussed above. The payoff

structure refers to the relative size of the personal returns from cooperation versus the return from defection. As the returns from cooperation increased relative to the return from defection, the level of cooperation increased. Efficacy refers to the ability of a player to make a noticeable difference in the outcome of an *N*-person dilemma. Cooperation rates increase if players perceive their collaboration will make an obvious difference in the outcome. A large number of game experiments have found cooperation decreases as group size increases, however there have been some exceptions. Kullock points out that these inconsistencies may be because it is difficult to control all of the elements that vary as group size increases, even within an experiment. The final structural solution is to introduce sanctions; cooperation increases if players are allowed to sanction non-collaborative players.

Ostrom et.al (1994) review alternative game structures that have been applied to CPR situations and compare the predicted game outcomes to a set of laboratory experiments and CPR research case studies. The experiments revealed that the game rules governing player communication and the ability to sanction non-collaborative players had a significant influence on the group's ability to coordinate player's actions and limit over appropriation. Communication gave the players an opportunity to discuss and debate the relative group payoffs from cooperation and defection, and allowed them to create alternative strategies for coordinating group actions. Communication was common even when a cost was charged for the option to meet face to face. The costly sanctioning of anonymous non-collaborative players also increased the ability of the group to coordinate action by changing the relative payoffs of defection. The findings

from these experiments were consistent with the conclusions from the case study research.

More recent experimental work includes Andrioni, et.al. (2003) who tested the relative effectiveness of rewarding collaborative behavior (i.e. the carrot), punishing non-collaborative behavior (i.e. the stick) and a combination of rewards and punishment (i.e. carrot and stick) within a non-cooperative game experiment. They found that punishment had a stronger effect on behavior than rewards, when evaluated individually. But, the combination of rewards and punishment had a stronger effect than when rewards or punishment were used separately. Cinyabuguma, et.al. (2005) tested the effectiveness of the threat of expulsion within a public goods experiment. They found that the threat of expulsion, as a trigger strategy, significantly increased the level of cooperation, when compared to the no-expulsion baseline. They also pointed out that expulsion was actually used less than three times, on average, within the 15 period game, so the threat of expulsion was viewed as credible and sufficient to alter behavior.

Game theory and game experiments have been very useful tools for identifying and testing alternative solutions in the modeled social dilemmas and commons dilemmas. Although there are a variety of methods that have been identified to increase group coordination, there are four general player actions that consistently increase collaboration. They are; repeated interaction, reciprocity, communication and sanctions.

2.3. Alternative Uses of the Term *Free Riding*

The general use of the term *free riding*, or *free rider*, refers to an individual who benefits from the actions of others without bearing the appropriate costs (Ostrom 1990,

Ostrom, et. al. 2002, Dixit and Skeath 1999, Milgrom and Roberts 1992, Carlton and Perloff 2005, Cobia 1989, Brickley et. al. 2004, Besanko et. al. 2004). Although the term free riding was never used within Olson's discussion, the concept that individuals could receive the benefits from group activity without bearing their share of the costs was a central theme. Thus, free riding has become closely associated with collective action activities and is a primary concern for organizations attempting to provide goods with difficult to exclude benefits. Unfortunately, the term free riding does not have a precise definition or consistent usage within the social science literature, and has been used to describe a variety of alternative actions.

McMillan (1979) attempts to clarify the economic interpretation of the free rider problem, within a public goods context; "The free rider problem is in fact not one, but three separate problems. In order for a Pareto optimum to be reached in an economy with a public good, there is a need, firstly, for consumers to contribute enough revenue to pay for an optimal quantity of the public good. Secondly, it is necessary for agents to reveal their preferences for the public good (so that it can be known what is an optimal quantity of the public good). Thirdly, a different kind of problem arises when the number of agents consuming the public good becomes large." McMillan's discussion of the third problem, concerning a large number of agents, is similar to Olson's presentation on the problems facing latent groups.

Sandler (1992) presents the following description of free riding; "At times, free riding refers to the sub-optimality associated with the provision of the public good. At other times, especially with respect to empirical studies, it relates to the inverse relationship between an agent's contributions and those of the other agents. Free riding

also relates to the failure of individuals to reveal their true preferences for the public good through their contributions. Finally, it denotes the tendency for marginal and average contributions to decline with group size."

Discussions of free riding can also be found within the organizational economics literature. Alchian and Demstez (1972) used the term *shirking* to refer to free riding within team production activities. They argued that when it was difficult to measure the marginal contribution of each individual within a team production system, team members have an incentive to shirk. And, because marginal contributions were difficult to measure, market contracts for labor could not properly reward each individual's marginal contribution to the production process. Their solution was to assign a monitor, or manager, to oversee the production process. The monitor was given authority to expel team members who did not perform and would receive the residual benefits from the team production as compensation for their monitoring and enforcement activities. Within this context, free riding is presented as group members withholding effort.

Jenson and Meckling (1976) emphasized the problem of managerial shirking within hierarchical organizations as part of their more general discussion of principle – agent problems and agency costs. They point out that the principle – agent problem "exists in all organizations and in all cooperative efforts – at every level of management in firms, in universities, in mutual companies, in cooperatives, in governmental authorities and bureaus, in unions, and in relationships normally classified as agency relationships such as are common in the performing arts and the market for real estate."

The combined influence of the principle-agent problem and a large group of individual investors has lead to the development of a rich and diverse set of research

findings within the corporate finance and corporate governance literatures. As Megginson (1996) points out; "Clearly, with this many atomistic shareholders, no single 'owner' has the incentive to closely monitor corporate management, nor can that shareholder act unilaterally even if he or she is convinced that action is called for. This is a classic *collective action* problem. It is in the group's best interest for action to be taken (to monitor and discipline management), but it is in no individual group member's rational self-interest to precipitate action since he or she bears all of the cost of taking action, but the benefits are dispersed among the group." Both the corporate finance and corporate governance literatures focus on how market based solutions can alleviate these problems within publicly traded corporations. However, it is not clear how large collective action organizations, which are typically not publicly traded corporations, deal with principle – agent issues and monitoring managerial activities.

Although the general theme of free riding is similar across the various uses, the individual's specific actions are different. Within a public goods context, free riding is presented from an *exclusion based* perspective. This perspective views the inability to exclude the consumption of the collective goods as the condition which leads to free riding and typically views the individual interacting with the organization in a market based transaction. Free riding is described as an under provision of financial resources were individuals do not "purchase" the public goods being "consumed". At times, the failure of beneficiaries to reveal their true preferences for the public goods through their "purchases" is also discussed.

Within the organizational economics context, free riding is presented from a *measurement based* perspective. This perspective views the inability to accurately

observe and measure effort as the condition which leads to free riding and typically views the individual interacting with the organization through some form of formal or informal contract. Free riding is when individuals within a team production setting and/or agents fail to provide the appropriate amount of effort and/or human capital towards creating economic value. Free riding actions can include lack of effort, lack of monitoring activities and lack of attention to quality control.

The research findings from the game theory and game experiment area have introduced the potential for a third *interaction based* perspective of free riding behavior. Repeated interaction, communication, reciprocity and sanctioning are player actions that have been found to increase group coordination. However, if players choose not to participate in these activities, they could be viewed as free riding on the actions of other players.

The distinctions between the exclusion, measurement and interaction based perspectives of free riding should be considered broad classifications. They are intended to help identify the alternative conditions that can lead to free riding actions and highlight the specific activities or behaviors that can create challenges for collective action activities. Not all free riding actions can be place uniquely into one of these three general perspectives.

2.4. Integrating the Collective Goods Classification System with Free Riding Actions:

Ostrom (2003) has argued that there are different classes of collective goods that are created through group action and that the "attributes of the goods produced and allocated, as well as the rules used for their production and allocation, affect the diverse

incentives that participants face." This viewpoint implies that the type of collective good the group is attempting to supply may alter the form of free riding actions that are detrimental, as well as impact the methods available to mitigate problematic behavior. This section attempts to integrate Ostrom's collective goods classification system with alternative forms of free riding actions.

2.4.1. Pure Public Goods:

The primary collective action problem faced by groups providing pure public goods is how to induce individuals to bear the costs of supplying the goods. Pure public goods have both non-excludable benefits and are non-rivalrous in consumption. Because the benefits are non-excludable, the distribution of benefits cannot be used as an incentive for individuals to contribute resources, typically financial resources, towards the supply of the public goods. Most discussions of pure public goods supplied by private groups or organizations assume that individuals make voluntary resource contributions, so it is not clear whether the group or organization can create an allocation function for the group's costs.

Once again, free riding typically refers to individuals not "purchasing" the public good they are "consuming". A second form of free riding is where beneficiaries fail to reveal their true preferences for the public good. Because a uniform "price" cannot be determined, it is difficult for the collective action organization to estimate the demand for the public good, and thus supply an optimal amount.

2.4.2. Club Goods:

The specific collective action problems involved in creating club goods are not clear. The term club good was a result of the theoretical work that Buchanan (1965)

conducted when he introduced a theory of clubs, which attempted to fill the gap created between the definitions and analysis of pure public goods and private goods. A club has been defined as "a voluntary group of individuals who derive mutual benefit from sharing one or more of the following: production costs, the member's characteristics, or a good characterized by excludable benefits" (Sandler 1992).

Existing club theory has focused on using physical exclusion mechanisms, such as fences, gates, turnstiles, toll booths, or buildings to exclude access to the collective benefits and convert a non-rivalrous public good into a club good. Club theory assumes that club membership allows an individual access to both collective and private goods. Thus, a club produces and bundles a private good and a collective good for members who then pay entry fees to support the club's activities. Club theory also assumes that the total benefits derived from club membership are subject to some type of rivalry, such as crowding or congestion. As a result, the optimal club size, the optimal number and distribution of clubs and the setting of tolls are the primary focus of club theory.

There are two primary relationships that combine to establish an optimum club size. The first is the marginal rate of transformation and the marginal rate of substitution between the private good and the collective good. This relationship determines the optimal provision levels of the private and collective goods. The second is referred to as the *congestion function,* which traces the tradeoff between the benefits created by sharing club costs amongst more members against the "costs" of congestion, such as increased wait times or crowding, as the membership size is changed. These two functions are then solved simultaneously to determine the optimum club size. Club theory has been extended beyond Buchanan's initial work to include clubs with fixed and variable

utilization rates, heterogeneous membership characteristics, partitioned or non-partitioned populations[8] and inclusion of basic transaction costs.[9]

Thus, club theory relies on an exclusion mechanism, described as physical barriers, to prevent those individuals who do not contribute to the group's objectives from receiving the benefits of the bundled collective good and private good. The distribution of benefits is therefore controlled by the exclusion mechanism. The distribution of costs is controlled by the club charging entry fees, like a "lump sum" membership fee, a per-use or per-visit fee, or a combination of both. Using Olson's terminology, a club would be inclusive until the marginal benefit of adding one more member (spreading the costs over more members) was equal to the marginal cost of that member (increased costs due to crowding or congestion). At that point, an "optimum" club size is reached. After that point, the club would become exclusive.

Club theory implies that exclusion based free riding related to resource contribution and revealing preferences can be eliminated by using a physical barrier. If a club can prevent access it can charge a fee to those individuals who desire the collective good and use the fees to produce the good(s). Establishing an appropriate fee can be a challenge, but exclusion based free riding is eliminated because those who do not bear an appropriate share of the costs can be prevented access to the collective good, and the entrance fee requires members to reveal their preferences for the bundled goods. The club can also use a combination of flat rate membership fees and per-use fees to

[8] A partitioned population is when all the members within the population belong to only a single club. In contrast, a non-partitioned population is when individuals within the population can be members of multiple clubs.

[9] See Sandler and Tschirhart (1997) for a more complete discussion of these advances in club theory.

eliminate, or significantly reduce, any "exploitation" that may result from differences in member utilization rates. Club theory does not evaluate the performance of alternative organizational forms or ownership structures so free riding by the organization's management and employees, in the form of insufficient effort, and owners, in the form of insufficient monitoring of management, is not addressed.[10]

2.4.3. Common Pool Resources:

The primary collective action problem for common pool resources is regulating the consumption of the resource, or the distribution of benefits. Once again, CPR have the public good attribute of high exclusion costs, but consumption by one individual does reduce the amount available to others within the group. In most CPR situations, the common property is an existing natural resource (ex. irrigation reservoir, crude oil reserves, forest or fishing area). As a result, physical exclusion is very expensive or impossible. The primary problem is that individuals within the group appropriate more of the resource(s) than can be sustained. Therefore the group is concerned with allocating and monitoring the consumption rights to the common resource. This type of group is what Olson termed an *exclusive group*, because the group is attempting to exclude additional members and/or over consumption. Even though physical exclusion is not feasible, researchers studying CPR situations have spent considerable effort analyzing the institutions designed by groups to overcome excessive appropriation.

Many CPR situations require additional investment to enhance resource utilization and/or require maintenance costs to preserve the enhancements (ex. irrigation canals from a river, common ownership of irrigation wells and pumps, roads to access

[10] Sandler (1994) identifies the need to analyze alternative organizational forms as an area for further research within club theory and collective action activities.

forests). In these cases the allocation of both costs and benefits among group members are a concern.

Within the CPR literature, individual free riding can take several forms. The most common is when individuals appropriate a larger portion of the resource than is sustainable, which can be viewed as an alternative form of exclusion based free riding. Another type of free riding identified by Ostrom (1990) is when a group member failed to properly monitor and enforce the institutions created to restrict over appropriation, and is analogous to the Alchian and Demstez description of shirking within team production settings. Ostrom, et.al. (1994) described a third type of free riding when group members responsible for constructing and/or maintaining CPR enhancements (ex. irrigation canals, well pumps, or roads) failed to contribute the appropriate amount of financial resource and physical effort required for construction or maintenance.

2.5. Summary

Olson introduced a wide range of issues regarding the behavior of groups and the challenges confronting collective action activities. Research stimulated by Olson's propositions has revealed that there is considerable diversity in the type of collective goods groups are attempting to create, as well as the challenges these groups face and the methods available to enhance group benefits.

Free riding generally refers to an individual who benefits from the actions of others without bearing the appropriate costs, and is commonly presented as the core issue confronting collective action. However, the term *free riding* has been used to describe a variety of different actions and behaviors. The collective action literature emphasizes the inability of the group or organization to exclude the benefits of group action from those who do not contribute resources towards the supply of the collective goods. Thus, the free riding activity is not contributing resource, usually financial resources, towards the supply of the collective goods.

The organizational economics literature emphasizes the inability of the group or organization to accurately observe and measure an individual's contributions to group activities. As a result, group members can free ride by not providing the appropriate level of effort and human capital. The specific actions can include insufficient physical effort, monitoring and enforcement activities or attention to quality control. While game theory and experimental research has revealed the potential for an interaction based form of free riding where group members fail to engage in repeated interaction with other group members, communication activities and sanctioning actions that could enhance group coordination.

Several approaches have been proposed to mitigate free riding behavior. For large groups, Olson discussed coercion, a federated structure and using selective incentives. Although Olson never clearly outlined the use of selective incentives, research within the CPR area has revealed that the institutions used to assign property rights and allocate the benefits and costs of collective action activities can influence behavior and enhance total group benefits. Experiments based on alternative game theory settings have also indicated that combining rewards and punishment can increase group coordination. The implication is that the rules which the collective action organization uses to define membership and allocate benefits and costs can create selective incentives to influence an individual's behavior.

Exclusion is another critical concept presented as a method to mitigate, or possibly eliminate, free riding behavior. The ability to exclude the benefits from group action is presented as one, of the two, key determinants used to classify alternative types of collective goods. Club theory implies that exclusion based free riding behavior can be eliminated by using physical barriers. The CPR research findings have identified institutional exclusion mechanisms that were used to either restrict entry and/or limit appropriation of shared resources to reduce the problems created by over consumption or use. While experiments have shown that the credible threat of expulsion from the group, which implies some form of enforceable exclusion, has also improved group coordination and increased group benefits. The ability to restrict entry, limit access and expel non-collaborative members can be viewed as alternative forms of selective incentives, but may not be feasible for all collective action groups.

Game theory and experiments have also shown that the ability to discuss and coordinate alterative strategies and alter realized payoffs by punishing non-collaboration within repeated games can increase group coordination and enhance group benefits. Thus, creating an environment that encourages communication between participants and clarifies alternative participant strategies through regular interaction is something that a collective action organization could do to enhance group output.

And finally, gaining a clear understanding of the relationship between individual resource contributions and total group output may be important for understanding both the individual's incentives to participate in collective action and a group's ability to organize and supply collective goods.

Chapter 3

Research Questions and Hypotheses

The common economic presentation of pure public goods begins with a general utility function for a rational self interested individual who is attempting to maximize utility given a budget or resource constraint. The general representation of the individual agent's decision is[11]:

$$\underset{y^i\ Q}{\text{maximize}}\ \{U^i(y^i,Q) \mid p_y y^i + pq^i = I^i\}$$

y^i = quantity of pure private good(s) consumed by individual *i*.

Q = quantity of pure public good available = $q^i + Q^g$.

q^i = units contributed towards the public good by individual *i*.

Q^g = units contributed towards the public good by other individuals = $\Sigma_{j \neq i}\, q^j$.

p_y = the price of the private good(s).

p = the price of the public good.

I^i = the individual's budget or resource constrain, such that $I^i = p_y y^i + pq^i$.

Within this representation, the price of the private good (p_y), the price of the public good (p) and the units contributed towards the public good by other individuals (Q^g) are known and exogenous. The individual's decision is to determine the relative quantities of private good (y^i) and public good contributions (q^i) that will maximize their utility, given the budget or resource constraint. One of the key attributes of this representation, which separates this it from the standard economic optimization problem,

[11] See Cornes and Sandler (1996) and Sandler (1992) for a more detailed discussion of this representation.

is that the quantity of the pure public good available is dependent upon the contributions, or purchases, of both the individual as well as the contributions of others. It is this interdependence in the supply of the public good, where an individual chooses their contributions given the contributions of others, that has lead researchers to utilize non-cooperative game theory and Nash behavior to analyze collective action situations. Once again, because the benefits of the pure public good are non-excludable and non-rivalrous the individual agent can access the public good created by others without making appropriate contributions. Thus, there is a systematic tendency for individuals to under contribute resources towards the provision of the public good.

An extension of the pure public goods model that more closely resembles the conditions found in this study is the *joint products model*. The general representation of the joint products model is[12]:

$$\underset{y^i\, x^i\, Z}{\text{maximize}} \{U^i(y^i, x^i, z^i + Z^g) \mid p_y y^i + pq^i = I^i\}$$

y^i = quantity of pure private goods consumed by individual *i.*

q = unit of contribution which provides a private output x and a pure public output z.

q^i = units contributed towards the production of the joint output by individual i.

x^i = level of private good output from individual i's contribution, such that $x^i = f_i(q^i)$.

z^i = level of pure public good output from individual i's contribution, such that $z^i = g_i(q^i)$.

Z = quantity of pure public good available = $z^i + Z^g$.

Z^g = pure public good resulting from the contributions of other individuals, where $Z^g = \Sigma_{j \neq i}\, z^j$.

[12] This model has also been used to analyze the provision of impure public goods. See Sandler (1992) and Cornes and Sandler (1996) for a more detailed discussion of this representation.

p_y = the price of the private good.

p = the price of the units contributed towards the joint output.

I^i = the individuals budget or resource constraint, such that $I^i = p_y y^i + pq^i$.

Once again, the price of the private good (p_y), the price of the public good (p) and the units contributed towards the public good by other individuals (Z^g) are known and exogenous. The individual's decision is still to maximize utility and determine the relative quantities of private good (y^i) and collective good contributions (q^i) that will maximize their utility given the budget or resource constraint.

However, this extended model integrates two important attributes. The first is that an individual's contribution towards the provision of a collective good (q^i) can provide joint products in the form of a private good output (x) and a pure public good output (z). This joint production can influence the individual's contributions and will be expanded upon below. The second is that the individual's utility maximizing decision is still dependent upon the actions of others because the total provision of the pure public good (Z) is a result of the combined contributions of the individual (z^i) and the contributions of others (Z^g). Thus, the individual can still access the public good output without contributing the appropriate resources and there remains a systematic tendency to under provide resources. The free rider problem continues to be a concern.

Both of these general models present an agent who must determine the relative quantities of private good (y^i) and collective good contributions (q^i) that will maximize their utility given a budget or resource constraint. And, because both models contain a pure public good, there is a systematic tendency for the agents to under contribute

resources towards the provision of the public good. However, the composition of the collective good contributions is not specified.

3.1. Does free riding have multiple attributes?

This study focuses on the private provision of collective goods, where a formal organization has been created to help coordinate group activities and supply collective goods to group members. Thus, the group has been able to overcome the initial formation challenges and is providing some level of collective group benefits. However, because the primary collective good provided has public good attributes there is an under provision of the collective good due to free riding behavior.

The joint products model provides a general framework for considering the research questions addressed within this study. This model specifies that an individual's contributions towards a collective good can provide multiple outputs, both public and private. And, because one of these outputs is a public good, the rational utility maximizing individual still has an incentive to free ride on the contributions of others, although this activity may be mitigated by the provision of the private good[13]. However, it does not specify what resource contributions are required to supply the collective benefits. It is implied that these are financial contributes, such as taxes for a collective good provide by a government or fees and/or dues paid to a private organization.

However, the organizational economics literature and the results from game theory and game experiments suggest that individuals who are members of a private

[13] It is not clear what proportion of the joint output results in a private good output and what proportion is a public good output. It is implied that a substantial portion of the joint output is considered public. It is also not clear whether the marginal rate of transformation between the private and public goods output is constant or variable as the resource contributions vary.

collective action organization can free ride with respect to a variety of resource contributions and actions that can enhance the effectiveness of the organization, improve participant coordination and increase the supply of collective benefits. In other words, the individual's contributions modeled as q^i in the public goods model and joint products model may be a vector of resources and activities that are required to not only produce the collective goods, but also to ensure the effectiveness of the organization and enhance the coordination of the group members.

As mentioned earlier, the general usage of the term *free riding* or *free rider* refers to an individual who benefits from the actions of others without bearing the appropriate costs. However, the review of the theoretical literature indicates that there are a range of actions and behaviors that are described as free riding. Although these alternative descriptions are not inconsistent with the general usage of the term, they do represent alternative actions. Table 2 categorizes the alternative free riding actions described within the respective literatures and the proposed methods to mitigate these actions into three general perspectives; exclusion based, measurement based and interaction based.

Table 2: Summary and categorization of alternative free riding behavior and mitigation actions discusses in collective action, organizational economics and game theory & experimental literature.

Alternative uses for term *Free Riding*	Collective Action/Pure Public Goods/Common Pool Resources ***Exclusion Based Perspective***		Common Pool Resource and Organizational Economics ***Measurement Based Perspective***		Game Theory & Experiments[1] ***Interaction Based Perspective***	
	Behavior	Mitigation Action	Behavior	Mitigation Action	Behavior	Mitigation Action
Failure to contribute appropriate resource levels towards supply of collective goods or group benefits.	Failure to "purchase" collective good by voluntarily contributing financial resources	Small Group Size Coercion Federated Structure Selective Incentives	Failure to provide appropriate amount of resources (human, physical or financial resources) towards the production of the collective good and maintenance of the organization	Create an allocation function that rewards or punishes relevant behavior Assign a monitor or manager with expulsion privileges	Prisoner's Dilemma game: Do not collaborate or Defect.	Change Game Rules Change Game Payoffs Change both Rules & Payoffs Expulsion from group
Disproportional appropriation of shared resource above sustainable level	Over appropriation of shared resource	Establish property rights structure to limit appropriation				
Failure to reveal true preferences for "purchase price" so that appropriate quantity of collective goods can be supplied.	Failure to reveal true preferences so appropriate quantity of collective goods can be supplied.	Strong exclusion mechanism requiring "payment" before collective goods can be accessed.				
Failure to actively monitor actions of other group members and/or organization's management and employees			Failure to actively monitor group members and/or organization's mgt. and employees	Make actor residual claimant		

1 For non-cooperative games (i.e. player acts with own self interest).

Table 2 (cont.): Summary and categorization of alternative free riding behavior and mitigation actions discusses in collective action, organizational economics and game theory & experimental literature.

Alternative uses for term *Free Riding*	Collective Action/Pure Public Goods/Common Pool Resources ***Exclusion Based Perspective***		Common Pool Resource and Organizational Economics ***Measurement Based Perspective***		Game Theory & Experiments[1] ***Interaction Perspective***	
	Behavior	Mitigation Action	Behavior	Mitigation Action	Behavior	Mitigation Action
Failure to repeatedly interact with group.					Failure to repeatedly interact with group.	Encourage and reward repeated interaction
Failure to communicate with other group members to establish payoff function and identify strategies.					Failure to communicate with other group members to establish payoff function and identify strategies.	Provide environment to encourage communication Clearly identify form of production function
Failure to reward and/or punish non-collaborative group members			Failure to reward and/or punish non-collaborative group members	Implement low cost identification and monitoring methods Make rewards and penalties easy to understand and implement Initiate sequential graduated penalties	Failure to reward and/or punish non-collaborative group members	Support rewarding and/or punishing collaborative and/or non-collaborative behavior

1 For non-cooperative games (i.e. player acts with own self interest).

The implication from the literature is that free riding within collective action organizations may represent a variety of actions and/or behaviors that might exist simultaneously. However, this has never been empirically tested. Thus, the first research question within this study is:

Are there multiple member free riding actions and/or behaviors that coexist within the large collective action organization under analysis?

Hypothesis #1: There are multiple member free riding actions and/or behaviors that coexist within the large collective action organization under analysis.

H_0: There is a single dominant member free riding behavior within the large collective action organization under analysis.

3.2. Can free riding be influenced by organizational by-laws and policies?

Olson was the first to suggest that collective action groups could use selective incentives to target specific individuals within groups, or sub-groups of individuals, to reward group participate and resource contributions and/or punish non-participation. Within small groups, Olson proposed that social incentives such as "prestige, respect, friendship, and other social and psychological objectives" could be effective incentives due to the close interaction of the group members and the ability to observe individual behavior. Olson cautioned that social incentives were not effective for large groups because it was not possible for each individual within a large group to know all other group members and monitor their actions. However, a federated organizational structure that divided the large group into smaller sub-groups could maintain social incentives as a

form of selective incentives. This observation introduced the potential for an organization to utilize its structure and polices to create alternative selective incentives.

Olson also introduced the "by-product theory" to explain the creation and operation of large political lobbying groups, which supply public goods to their constituents. Olson argued that large groups, which could not utilize coercion, tied a private good to the desired public good to create another type of selective incentive for individuals to contribute resources towards the provision of public good. In other words, a public good is bundled with an excludable private good, which in turn acts as a selective incentive for individuals to contribute resources towards the provision of the public good.[14] Olson stated, "Only such an organization could make a joint offering or 'tied sale' of a collective and non-collective good that could stimulate a rational individual in a large group to bear part of the cost of obtaining a collective good."

The by-product theory has been criticized by some authors (Stigler 1974, Oliver 1993) because it was argued that adding the costs of supplying the public good to the private good would increase the cost of the private good. These increased costs would make the private good less competitive in the market and other firms, selling the same private good, would offer the private good at a lower price and bid away the organization's members.

In a footnote (fn. 2, pg. 133), Olson partially anticipated this criticism. He stated; "An economic organization in a perfectly competitive market in equilibrium which had no special competitive advantage that could bring it a large amount of 'rent', would have no 'profits' or other spare resources it could use as selective incentives for a lobby.

[14] An example would be an environmental lobbying group that publishes a newsletter or magazine, discussing current issues and/or the activities of the organization, which is only available to individuals who make contributions to the organization or pay membership dues.

Nonetheless there are many organizations that do have spare returns they can use for selective incentives. First, markets with some degree of monopoly power are far more common than perfectly competitive markets. Second, there are sometimes important complementarities between the economic and political activities of an organization."

Sandler (1992) reviews Olson's discussion of the by-product theory as a selective incentive and points out that the by-product theory stimulated research into testing the presence of *joint products* within collective action activities. Joint products are created when "the collective activity yields multiple outputs that vary in their degree of publicness." The general representation of this model was provided above. These research findings indicate that joint products are common within collective action organizations, can increase total contribution levels for the public goods and can more closely align the relationship between the costs of supporting the organization and the benefits received by participants. However, there is no general proof that the presence of joint products can eliminate suboptimal provision levels.[15]

Sandler also discusses Olson's proposed use of a federated organizational structure and adds that very little research is available on how alternative institutional structures influence collective action. Sandler states; "If the efficacy of alternative organizational structures is to be ascertained, discrete organizational forms must be compared with one another to identify the structure with the greatest net gains when provision and transaction aspects are considered."

It should be noted that Sandler viewed the term selective incentives as synonymous with the supply of joint products, while institutional structures were

[15] See Cornes and Sandler (1996) for a theoretical discussion of the joint products model, Sandler (1993) for a survey of empirical research using the joint products model applied to military alliances and Sandler & Hartley (2001) for a recent application to military alliances.

presented as an alternative method to overcome collective action problems. However, Olson's definition of selective incentives indicates a much broader usage which could encompass both joint products and alternative institutional arrangements. Also, both Olson's and Sandler's discussions focus on collective goods with public good attributes and maintain the exclusion based viewpoint of free riding. The objective is to create incentives to encourage the "consumers" of the collective good to "pay" for the good.

In contrast, utilizing institutional arrangements to create alternative bundles of property rights and reduce over appropriation of shared resources is one of the major efforts within the CPR research arena. Schlager and Ostrom (1992) and Ostrom (2003) discuss five alternative property rights that are relevant to CPR situations, they are defined as:

> 1) Access – the right to enter a defined physical area and enjoy non-subtractive benefits (ex. hike, canoe, sit in sun)
>
> 2) Withdrawal – the right to obtain resource units or products of a resource system (ex. catch fish, divert water)
>
> 3) Management – the right to regulate internal use patterns and transform the resource by making improvements.
>
> 4) Exclusion – the right to determine who will have an access right, and how that right may be transferred.
>
> 5) Alienation – the right to sell or lease exclusion, management or withdrawal rights.

They argued that the economics literature focuses on the right of alienation as the key property right for efficient resource allocation because it allows the rights to a resource to be transferred between individuals allowing it to be placed in the highest valued use. And, if the property rights structure does not contain the right of alienation it

is termed *ill-defined*. However, Ostrom (2003) argues that the right of alienation may not play as critical a role in CPR settings; "Instead of focusing on only one right, it is far more useful to define five classes of property-rights holders as shown in Table 1 (reproduced as Table 3 within this text). In this view, individuals or collectivities may hold well-defined property rights that include or do not include all five of the rights defined earlier. This approach separates the question of whether a particular right is well defined from the question of the effect of having a particular set of rights."

Table 3: Bundles of Rights Associated with Positions

	Full Owner	Proprietor	Authorized Claimant	Authorized User	Authorized Entrant
Access	X	X	X	X	X
Withdrawal	X	X	X	X	
Management	X	X	X		
Exclusion	X	X			
Alienation	X				

Ostrom, Elinor (2003) 'How Types of Goods and Property Rights Jointly Affect Collective Action', *Journal of Theoretical Politics* 15(3): 239-270

This is a modified view of the private property rights allocation recommendations found within the organizational economics and contracting literature. Within a private property rights context, the objective is to equate the residual rights of control for an asset's use with the residual claims from the asset's cash flows. The challenge is to establish an institutional framework that defines who has control rights over alternative aspects of an assets use, who has rights to the cash flows generated from these uses and how these rights can be transferred, either individually or bundled, between actors in a low cost, secure manor so the asset can be utilized most efficiently.

However, within a CPR setting the core issue is how to establish and maintain a sustainable resource utilization rate that provides the greatest net benefits for the users of the shared resource. Thus because physical exclusion is either prohibitively expensive or impossible, resource users have relied on alternative rules and policies to establish bundles of rights for use, or access to "revenues" from the resource, and control rights to reduce over appropriation and create and sustain resource enhancements. The general findings indicate that, although there are complex interactions between the political, physical and social environment surrounding the CPR, groups have been able to establish, enforce and sustain alternative property rights arrangements to mitigate free riding behavior.

There is compelling evidence from the CPR research studies to support the use of alternative institutional structures to create incentives which mitigate free riding activities. However, there were no research studies found which tested the use of institutional arrangements to mitigate free riding for organizations supplying public goods and/or club goods. This is the basis for the second research question within this study:

Can member free riding be influenced by the by-laws and policies of the collective action organization under analysis?

Hypothesis 2: Member free riding can be influenced by the by-laws and policies of the collective action organization under analysis.

H_0: The by-laws and policies of the collective action organization under analysis do not influence member free riding actions and/or behavior.

Chapter 4

Cooperatives as a Unit of Analysis

Cooperatives have been described as private organizations which focus on creating user benefits, and are also owned and controlled by users (Hansmann, 1996 and USDA, 1987). Cooperatives also face many of the same challenges that are discussed in the collective action literature, including member free riding.

4.1. Agricultural Cooperatives: A Form of Collective Action

Sexton (1986) stated "Cooperatives economic function is to integrate vertically their members into the marketing chain, either upstream (a purchasing cooperative) or downstream (a marketing cooperative). The distinguishing feature of cooperative integration is its jointness. Agents horizontally coordinate (form a club) to accomplish vertical integration. Thus, to explain cooperatives' role in a market-oriented economy is simultaneously (*a*) to enumerate farmers' incentives to integrate vertically and (*b*) to identify reasons for coordinated (i.e. cooperative) rather than individual integration."

Sexton presented a generalized example using a utility maximization format. Assume that $U^*(\{i\})$ and $U^*(\{j\})$ are the maximum expected utility for two producers acting independently, while $U^o(\{i\})$ and $U^o(\{j\})$ are the maximum expected utility if they individually vertically integrated. If $U^o(\{i\} \cup U^o\{j\}) > U^*(\{i\}) + U^*(\{j\})$, then the producers have an incentive to "cooperatively vertically integrate."[16] Thus, if the utility realized by jointly vertically integrating is greater than the sum of their individual utilities from acting independently, the individuals have an incentive to cooperatively vertically

[16] Note: Club theory assumes: $U^o(\{i\} \cup \{j\}) > U^o(\{i\}) + U^o(\{j\})$

integrate. Although this is not a formal statement that cooperative members are attempting to create collective benefits, the implication is that the members are trying to create benefits as a group that cannot be achieved by individual action.

Nourse (1922) was one of the first to discuss the economic motivation for forming cooperative business organizations. He argued that a cooperative's primary function was to act as a "competitive yardstick" and ensure that local markets for agricultural inputs and production remained as close to a perfectly competitive market as possible. Under this rational, the competitive pressure from the cooperative would eliminate any potential economic rents from the local market. This elimination of economic rents is consistent with the description of a pure public good. Once formed and operating, the cooperative cannot exclude those individuals who do not patronize the cooperative from receiving the benefits of more competitive local market prices and the market price benefits do not exhibit consumption rivalry.

Shortly after Nourse's article, Sapiro (1993, reprinted from 1923) argued that the primary objective of an agricultural cooperative should be to enhance farm level product prices by establishing a dominant presence in the market place and should attempt to extract favorable prices through group selling. This strategy, which exploited institutional support[17], would be implemented through tightly controlled long-term member marketing contracts. Sapiro also emphasized the need for the cooperative to maintain producer member/owners and should not allow non-producers, such as general investors, membership. This strategy could result in either the creation of club goods or

[17] The Capper-Volstead Act of 1922 allows limited exemption from federal antitrust laws for qualifying agricultural cooperatives.

pure public goods and would depend upon the number and size of producers who joined the cooperative and the competitive response by of other firms in the market.

Staatz (1987) used a transaction cost economics (TCE) approach to evaluate two questions: 1) under what conditions do farmers benefit from collective action and 2) under what conditions would a farmer owned cooperative be the preferred form of collective action? The focus of this paper was to identify the incentives to form a cooperative rather than on the incentives to maintain the cooperative once it was organized.

Staatz argued that asset fixity in farming creates rents at the farm level which either upstream or downstream trading partners could potentially capture by acting opportunistically. And, that asset fixity within the upstream or downstream businesses creates entry or exit barriers which discourage the entry of new firms, giving the existing firms a degree of market power. Given this scenario, farmer cooperatives would be most likely to organize when assets on both sides of the market are highly specialized and/or product and factor markets are fragmented, leading to a divergence between the values of the asset in its current use and its value in an alternative use. Thus, a cooperative would counterbalance the market power of the trading partner by either creating competitive pressure and "increasing the efficiency of the economic system", as proposed by Nourse, or "redistribute existing income in the farmers' favor", which is analogous to Sapiro's view.

Staatz continued the TCE analysis by discussing how uncertainty increased the potential for opportunistic trading behavior, as well as increased the costs of renegotiating contracts. He indicated that farmer owned cooperatives could reduce the

potential for opportunistic trading by both the farmers and the cooperative firm due to the farmers' joint ownership and patronage relationship, relative to an investor owned firm (IOF). Cooperative firms could also offer a degree of price risk management by "contingency pricing" through patronage refunds and/or pooling arrangements[18]. These price risk management benefits would be most advantageous for commodities which did not have futures markets available. He also briefly mentioned that a reduced potential for opportunistic trading could lower the risks of long term capital investments in new technology for both the farmer and the cooperative firm.

The final rational for farmers to form a cooperative firm was to "internalize externalities imposed on them by their trading partners." Examples included a commodity buyer with inadequate quality controls for perishable farm products that supplied lower quality products to the market and reduced farm level demand, or new farm inputs with quality attributes that were difficult to observe and/or measure and the suppliers' reputation had not been established.

One of the key insights offered by Staatz, which is pertinent for this study, was that there were two ways a cooperative could create benefits at the farm level. The first was through price adjustments by either stimulating general local market price correction, a public good, or enhancing the effective transfer price between the member and the cooperative, a club good. The second form of benefit was through reducing farm level transaction costs like initial search and bargaining costs, contract renegotiation costs

[18] The term *pooling* referrers to the process of sorting a farmer's deliveries, usually for a single commodity, into different marketing pools based on quality characteristics, grades or time of delivery. These separate marketing pools, which contain the deliveries of many different farmers, are then sold and the net proceeds distributed proportional to each farmer's contribution to the respective pool. Some cooperatives have created multi-commodity pools where farmer payments are based upon an average price received for all commodities within the pool, rather than a single commodity.

and/or the cost of managing risk and uncertainty from potential opportunistic trading behavior. This second set of farm level benefits is specific to the patronage relationship and could be classified as either club goods or private goods, depending upon the degree of consumption rivalry.

Peterson (1992) proposed a discounted cash flow method to estimate the combined farm level and cooperative level financial benefits and assess the return from cooperative membership. He emphasized that an individual makes a joint decision to patronize and invest in a cooperative when they become a member. This is different than the separate patronage and investment decisions made when utilizing non-cooperative firms. As a result, both the cash flows from the cooperative's assets and the cash flows from farm assets as a result of cooperative patronage must be included when estimating the total value from cooperative membership. The discounted value of the combined cooperative membership cash flows are compared to the discounted cash flows from investment in other assets plus the farm level cash flow as a result of patronizing a non-cooperative firm. Peterson enumerated these concepts in the following functional form[19]:

$$\left(\frac{X \times Ac}{r} - X \times Vc\right) + \frac{Fc}{r} \quad \rangle \quad \left(\frac{Y \times An}{r} - Y \times Vn\right) + \frac{Fn}{r}$$

- X = A member's required proportion of investment to join the cooperative.
- Ac = Periodic ownership cash flows generated by a *cooperative's assets.*
- Vc = The equity value of the cooperative.

[19] Peterson made four simplifying assumptions within this initial equation, they are: 1) all cash flows are perpetual and certain, 2) agricultural producers are rational; they seek to maximize their wealth; and, they evaluate investment opportunities in a manner consistent with net-present value techniques, 3) agricultural producers can choose to patronize a cooperative or a non-cooperative firm, and 4) agricultural producers can invest in financial assets offered through an efficient capital market. The assumption of perpetual and certain cash flows was relaxed later in the article, but the fundamental relationships did not change.

- Fc = Periodic ownership cash flows generated by a potential member's *farm assets* if the a cooperative is patronized.

- Y = A proportion of investment that forces $X \times Vc = Y \times Vn$.

- An = Periodic ownership cash flows generated by a non-cooperative's assets.

- Vn = The equity value of a non-cooperative investment.

- Fn = Periodic ownership cash flows generated by a potential member's *farm assets* if a non-cooperative firm is patronized.

- r = The riskless rate of return.

Thus, if the combined cash flows from cooperative patronage and investment were greater than the combined cash flows from non-cooperative patronage and other investment alternatives, an individual has an economic incentive to become a cooperative member. Although the concept that the value from cooperative membership can be created at both the cooperative level and the farm level was not new, Peterson formalized these concepts, presented a procedure for estimating the relevant values and provided a basic decision rule.

Peterson also pointed out that if one assumes that the same amount will be invested in either the cooperative or non-cooperative investments ($X \times Vc = Y \times Vn$), the previous equation reduces to:

$$X \times Ac + Fc > Y \times An + Fn$$

This equation implies that a cooperative firm has a set of business strategies which could be used to maintain the inequality, and provide an economic incentive for individuals to establish and maintain membership. For example, if the farm level asset cash flows are the same for both cooperative and non-cooperative patronage ($Fc = Fn$), the cooperative must generate greater firm level asset cash flows than the alternative non-cooperative

assets. However, if the asset cash flows are the same for both the cooperative firm and non-cooperative investments (X x Ac = An +Fn), the cooperative must create greater farm level patronage benefits than the non-cooperative firm. Peterson used the term *differential patronage cash flow* to represent this concept and defined the quantity as Fc-Fn. [20]

Peterson and Anderson (1996) combined the concept of differential member returns with the existing cooperative theoretical literature to outline 12 alternative cooperative business strategies which could enhance farm level benefits and provide the cooperative with a competitive advantage over IOFs. Table 4 reproduces the taxonomy of theoretical cooperative strategies identified within the article.

By creating this taxonomy of differential member returns, Peterson and Anderson have begun the process of identifying collective benefits that can be created by agricultural cooperatives. However, the authors made no attempt to identify how these differential member returns would manifest themselves or whether they would be classified as private goods, public goods, club goods or common pool resources.

Peterson and Anderson conducted interviews with the chief executive officers of 21 northeastern U.S. cooperatives to determine the relative use of the identified strategies. Table 5 reproduces the summary of their empirical findings.

[20] Peterson also noted that if Fc was significantly greater than Fn, (X x Ac) could be less than (An +Fn).

Table 4: Taxonomy of Theoretical Cooperative Strategies

Strategy			***Source of Differential Member Returns***
Returns Strategy	Countering Market Power	Competitive Yardstick	Elimination of dead weight loss from market power.
		Countervailing Power	Bargaining strength moving market equilibrium toward competitive ideal.
	Improving Cost Efficiencies	Deal Costs	Information economies in contracting, monitoring, planning, communicating and enforcing deals that arise in exchange.
		Agency Costs	Information economies in monitoring management and strategies.
	Serving Missing Markets	Member Demand	Information economies in regard to member product specifications.
		Consumer Demand	Information economies in regard to farm level effects and product specifications from the consumer level in the market chain.
Risk Management Strategies	Direct Strategies	Pooling	"Averaging" prices across time and markets.
		Savings Bank	Saving member returns in "good" times and paying them back in "poor" times.
		Maintain the Market	Producing returns in times when non-cooperative firms would abandon a market
	Indirect Strategies	Conservative Investment	Restricting cooperative investment to "safe" assets
		Diversification	Expanding cooperative investment to include risk reducing, non-member-centered assets
		Selective Vertical Integration	Integrating into markets with negative covariance between cooperative and member returns

Peterson, Christopher H. and Bruce L. Anderson (1996), "Cooperative Strategy: Theory and Practice", *Agribusiness*, Vol. 12, No. 4: 371-383

Table 5: Summary Frequencies of Strategies Used by Sample Cooperatives

Strategy			***Number of Cooperatives Utilizing***	***Percent of Relevant Sample***
Returns Strategy	Countering Market Power	Competitive Yardstick	21	100
		Countervailing Power	6	29
	Improving Cost Efficiencies	Deal Costs	3	14
		Agency Costs	—	—
	Serving Missing Markets	Member Demand	6 (supply/service) 1 (marketing)	60 9
		Consumer Demand	3	27
Risk Management Strategies	Direct Strategies	Pooling	2	10
		Savings Bank	8	38
		Maintain the Market	17	81
	Indirect Strategies	Conservative Investment	20	95
		Diversification	16	76
		Selective Vertical Integration	1	5

(—) Reducing agency costs was dealt with separately because no direct evidence about this strategy arose from the interviews.

Peterson, Christopher H. and Bruce L. Anderson (1996), "Cooperative Strategy: Theory and Practice", *Agribusiness*, Vol. 12, No. 4: 371-383

Even though the sample size is not large, it is clear that all of the cooperatives interviewed had adopted a mixture of business strategies that create multiple member level benefits. This observation has ramifications for using agricultural cooperatives to study free riding behavior because existing collective action theory does not fully address the complexities of organizations that create multiple collective goods. This issue will be discussed in greater detail in Chapter 6.

4.1.1. Free Riding within Cooperatives:

Free riding within cooperatives is most commonly discussed within the context of Nourse's competitive yardstick strategy, due to the public goods nature of the farm level benefits. Once the cooperative is formed and operating, the competitive pressure from its activities results in more competitive market prices, which removes the incentive for the cooperative's members to contribute resources towards the maintenance and/or growth of the organization. Over time, individuals leave the cooperative because they can still receive the benefits from the cooperative's activities (i.e. competitive market prices) without having to bear the opportunity cost of their time and capital, which in turn threatens the viability of the cooperative.

Cook (1995) provided a more detailed description of the basic stages within an agricultural cooperative's life cycle. He outlined not only the economic justification for forming a cooperative, but also how the internal property rights structure of the cooperative can influence the performance of the organization as it adjusts to a changing external economic environment. Cook argued that after the cooperative is formed, competing firms alter their strategic behavior and market prices adjust. Members then begin to focus more attention on the transaction costs of doing business with the cooperative, especially those relating to their joint patronage and investment responsibilities. He states; "These costs are generated by a vaguely defined 'user versus investor' set of property rights. These vaguely defined property rights lead to conflicts over residual claims and decision control – especially as the cooperatives become increasingly complex in their organizational structure."

Cook identified five general problems that are created by the conflicting user and investor property rights. They are 1) the Free Rider Problem, 2) the Horizon Problem, 3) the Portfolio Problem, 4) the Control Problem and 5) the Influence Costs Problem. He went on to argue that it was the ability of the cooperative's decision makers to manage the tradeoffs between these conflicting user and investor property rights that would determine if the cooperative 1) *exited* (liquidated or restructured as an IOF), 2) *continued* operations after making adjustments or 3) *shifted*, to a New Generation Cooperative structure.

Cook focused on the free rider problem within the context of the conflicting user and investor property rights. He argued that the free rider problem is created when "property rights are untradable, insecure or unassigned" and discussed two alternative forms of free riding. The first occurred when the property rights structure did not "ensure that current member-patrons or current non-member-patrons bear the full costs of the actions and/or receive the full benefits they create." This form of free riding was most prevalent within open membership cooperatives. The second, termed the *insider free rider problem*, occurred when "new members obtain the same patronage and residual rights as existing members and are entitled to the same payment per unit of patronage." Thus the untradable, insecure or unassigned property rights allowed members and non-members to free ride within the cooperative, and "a disincentive is created for them to invest in their cooperative."

Along with the specific discussion of the free rider problem, Cook also discussed the horizon problem. The horizon problem occurs when a member's rights to the cooperative's net income have a shorter time horizon than the productive life of an

investment made by the cooperative, and these residual claim rights are not appreciable and transferable. As a result, members pressure the cooperative's leadership to increase the portion of the cooperative's net income that is returned to members in cash and/or reduce the length of time retained earnings are held before being returned.

For example, there is little incentive for a member of a traditional open membership cooperative who is nearing retirement to contribute additional financial resources to a cooperative that is making investments in assets which create long term returns. This example indicates a potential linkage between the free rider problem and the horizon problem where older members are less willing to support long term investments by the cooperative.

Iliopoulos (1998) and Cook and Iliopoulos (2000) used Cook's (1995) framework to empirically test whether the cooperative's policies used to address the free rider, horizon and portfolio problems influenced a member's decision to invest in the cooperative business. They used a latent variable model to analyze survey data collected from 127 U.S. agricultural cooperatives, representing 75 percent of the total 1996 gross sales by US cooperatives. They empirically tested the following hypothesis: "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 such as traditional cooperatives characterized by open membership, voluntary member commitment, non-transferable and non-appreciable equity instruments, and no formal short-term equity redemption plan." Their findings indicate that closed membership policies, the use of marketing agreements, the existence

of separate capital pools and the ability to transfer appreciable delivery rights had a significant influence on a member's incentive to invest.

Krumpelman-Farmer (2005) tested for the existence of the horizon problem within four agricultural cooperatives with different organizational structures. Krumpelman-Farmer found the presence of four different types of horizon problems and the possible existence of a fifth problem, and that the degree of the horizon problems varied by cooperative characteristics. The four identified horizon problems were termed; *wait-to-receive, hassle, current obligation,* and *short-term residual* horizon problems.

The wait-to-receive and the short-term residual horizon problems are the most relevant to this study. The wait-to-receive horizon problem referred to an inactive or retired member who preferred to have more rapid redemption of older retained equity and did not want to wait to receive their retained investment. The short-term horizon problem referred to an active member who was nearing retirement and had a preference for the cooperative to make investments in assets with short term repayment periods. These horizon problems resulted from the age and patronage horizon of the member and were most significant for cooperatives that created user, or member level benefits, rather than investor benefits and utilized passive member investment through retained earnings. Once again, these findings indicate a potential linkage between investment based free riding and these two horizon problems.

4.1.2. Summary

Agricultural cooperatives place an emphasis on creating user benefits, while maintaining user control and user ownership, and have been described as producer based collective action. The benefits from these collective efforts are realized at both the

cooperative firm level and at the member level. For some cooperatives, a large portion of the total membership value takes the form of more competitive local markets, which can be classified as a public good. Member free riding within cooperatives has been presented as a challenge confronting many cooperative businesses. Therefore, studying the activities of agricultural cooperatives may provide insights into how collective action organizations have dealt with free riding actions and behavior.

4.2. Using Cooperative Policies to Create Selective Incentives:

Those who study cooperative business organizations recognize that cooperatives are found in a wide range of industries and operate under a diverse set of business objectives. This has resulted in a correspondingly diverse set of organizational by-laws and policies. One unanswered question is whether these alternative by-laws and policies have the capacity to influence free riding actions and behavior.

This section briefly outlines alternative policies found within U.S. cooperatives and describes how they may be used to create institutional exclusion mechanisms and/or selective incentives to influence participation in the collective action activities.

4.2.1. Membership Policies as Selective Incentives:

A cooperative's by-laws and policies specify the conditions that are required for an individual, or association in the case of a federated cooperative, to be classified as a member. If these conditions are met, the individual or association is granted voting privileges in cooperative governance matters. These privileges include 1) nominating and electing individuals, usually peers, to serve on the board of directors, 2) voting on the merger, consolidation or dissolution of the cooperative, 3) voting on changes to the

existing by-laws and 4) voting on any other major issues facing the organization. Most cooperatives have adopted a one vote per member voting policy, which is different from the typical corporate system which uses a one vote per equity share policy. Some cooperatives, typically larger regional cooperatives, have adopted proportional voting systems based upon patronage, either current or historical, and/or the number of members, for those utilizing a federated structure.

The by-laws and policies also specify, in a very broad and general way, the responsibilities of the board of directors and the cooperative's officers. In organizational economics terminology, these provisions outline the member's residual control rights.

Defining and allocating control privileges within an organization could be used as an institutional exclusion mechanism to create and allocate selective incentives. If there is a relatively low cost method for distinguishing members from non-members or differentiating different classes of members, granting access to alternative bundles of control rights could be used to reward resource contributions to the organization.

Within cooperatives, the patronage relationship is defined and measured by the purchase and/or sale of private goods. In order for the cooperative to accurately allocate and distribute net income to members proportional to use, and qualify for preferential tax treatment, the cooperative must maintain current information on each individual that meets the membership criteria, as well as information about transactions that are completed by each member. Therefore, a cooperative can use personal characteristics (ex. age or geographic location), business characteristics (ex. farmer vs. non-farmer or livestock vs. crops or corn vs. soybean), annual patronage levels, cumulative patronage

amounts, or minimum equity contributions as criteria to define membership or differentiate membership classes.

Cooperatives may also be able to use the definition of a member to provide product pricing differentials to members. For example, if the other firms in the market offer only a limited response to the cooperative's business activities, the cooperative may be able to offer preferential prices to members and price discriminate between members and non-members. The cooperative may also be able to write different supply or purchase contracts with members, versus non-members, that offer preferential prices or terms. Some cooperatives have indirectly influenced member level prices by creating liberal credit polices for purchases.

4.2.2. Allocating and Distributing Cooperative Net Income to Create Selective Incentives:

Once again, one of the basic principles that distinguish a cooperative from other business models is the distribution of cooperative benefits proportional to use, or patronage, rather than proportional to investment. These benefits usually refer to the allocation and distribution of the cooperative's net income, rather than farm level benefits. There are several different methodologies that have been developed to allocate and distribute cooperative net income. Typically, the cooperative's board of directors establishes a policy that details the methodology that will be used. These methodologies and policies have been heavily influenced by the federal and state income tax laws and regulations governing the taxation of the cooperative's net income. Most cooperative's allocate and distribute net income to voting members only. However, this is not required and there are situations were non-members receive portions of the cooperative's net

income. In organizational economics terminology, the cooperative's net income allocation policies outline the rights to residual claims from the organization.

Cooperative finance and taxation are very complex topics and a full presentation is beyond the scope of this study. However, a basic description is needed to illustrate how a cooperative can use income allocation and distribution policies to influence member level benefits and costs, and reward or penalize member actions similar to the allocation function discussed within the CPR literature.

4.2.2.1. Allocation: Typically, a cooperative's net income is allocated, or divided and assigned, to each member based upon some measure of patronage. Patronage can be measured in physical units or dollar volume of purchases or sales. For example, if Farmer A purchased two percent of the total tons of fertilizer sold by a fertilizer cooperative, Farmer A would be assigned two percent of the cooperative's net income. Income allocation for a multipurpose cooperative is more complex. A multipurpose cooperative has more than one business unit (ex. sells fuel, fertilizer and feed). Therefore, a multipurpose cooperative can allocate the total net income from all business units combined and use a member's combined patronage as the basis for allocation. Or, the cooperative can consider each business unit a different profit center and allocate income based upon a member's patronage within each unit. For multipurpose cooperatives, the choice of alternative allocation systems can send different economic signals to members regarding their patronage of the cooperative in general versus patronage of specific business units.

4.2.2.2. Distribution: Once the cooperative has allocated the net income, it must determine how much of the total allocation will be distributed to members as *cash*

patronage, and how much will be withheld as *retained patronage* for use as equity within the cooperative. The cash portion is distributed to members, typically at the annual meeting, in the form of a patronage check. The retained potion is added to each member's "individual equity account" and held for a period of time. The summation of each member's equity account is the cooperative's total member equity, which is listed on its balance sheet, and is commonly the primary source of equity capital for the cooperative. In order to qualify for preferred income tax treatment, the cooperative must distribute a minimum of 20% of each member's total allocation in cash. Some cooperatives have adopted policies that return as much as 60% - 70% of the total allocation in cash.

Most cooperatives do not have tradable equity shares to transfer ownership between individuals, but rather redeem the individual's retained earnings at book value based upon a policy established by the cooperative's leaders. There are four basic systems that are used to redeem member equity. The first is to hold the annual retained allocation for a specific period of time (ex. 10 years) and then return the retained portion. The second is to redeem a percentage of the total accumulated amount each year (ex. if member's total accumulated equity is $50,000 and 10% is redeemed each year, then $5,000 is redeemed). The third is to redeem the total accumulated amount when a "trigger event" occurs. Some common trigger events include reaching a specified age, exiting the cooperative's trade area, discontinue cooperative membership or death (ex. member's total accumulated equity is $50,000 and age 72 is trigger event, then $50,000 received by member at age 72). The final system is called a base capital plan. Under this system, the cooperative's leadership first determines the amount of total equity required

by the cooperative. Then, the amount of equity contribution required by each member is established and is based upon the member's historical patronage. This required amount is compared to the actual amount within each member's current equity account. If the member is "over invested" (actual amount > required amount) a portion is redeemed. If the member is "under invested" (actual amount < required amount) the member must make additional equity contributions.

In order to be classified as equity by the financial community, the redemption of retained allocations must be made at the discretion of the cooperative's board of directions. So, even though an equity redemption policy has been established, there is no legal requirement to follow the policy. The board of directors has the authority to decide when and how to redeem equity based upon the financial condition of the cooperative, the loan covenants within financing agreements and the economic environment the cooperative operates within.

The combination of the cooperative's income allocation and equity redemption policies can play a significant role in determining which members, or sub-group of members, receive the financial benefits created at the cooperative level and bear the responsibility for providing equity capital. If carefully managed, these policies could target selected member actions and be used as selective incentives. However, as Cook cautioned, an imbalance between the "user" property rights (i.e. one vote per member and allocation of net income based upon patronage) and the "investor" property rights (i.e. equity capital investment) can create conflict which may lead to the demise of the organization. Thus, establishing an effective set of incentives and modifying them as economic conditions change could be a challenge.

4.2.2.3. Taxation: A cooperative's net income is almost always taxed once, either at the member level or at the cooperative level. If the cooperative's net income is allocated to members proportional to use, the member is taxed for the *full amount* of the allocation even though only a portion is received in cash. When the retained, or equity, portion of the allocation is redeemed, the member is not taxed again. However, if the cooperative does not allocate net income to members but instead retains the income for general use within the cooperative, referred to as an unallocated reserve, the cooperative is taxed on that amount at the appropriate corporate income tax rate. The funds in an unallocated reserve almost always remain within the cooperative for the life of the firm. If these funds are re-allocated to members and redeemed, the income is usually taxed again at the membership level, which results in double taxation.

4.2.2.4. Per Unit Capital Retains: Some cooperatives, usually marketing cooperatives, do not calculate and distribute cooperative net income, but use an alternative process referred to as a *Per Unit Capital Retain* system. In this system, a farmer member delivers production for marketing and/or processing, and is paid an initial amount at the time of delivery. Then, additional payments are made periodically to members throughout the marketing/processing period as the cooperative sells the product. At the end of the fiscal period, the cooperative subtracts its total costs and accumulated member payments from its gross sales to calculate a "final member payment". As a result, the cooperative always has zero accounting profit for tax purposes. A portion of the final payment is withheld from each member, on a per-unit delivered or marketed basis, as an equity contribution to be used within the cooperative. This retained amount is redeemed at a future time using one of the methods described above. The member

must claim the sum of all payments as income for tax purposes, even though a portion is retained by the cooperative.

Cooperatives that use this allocation and distribution system are sometimes referred to as *pooling cooperatives*. This is because the cooperative can establish different payment "pools" based upon different commodities, grades and/or quality standards. Some cooperatives have aggregated or averaged the costs and returns from different grades or commodities into a single pool before making a final member payment. In contrast, other cooperatives have maintained separate payment pools and calculate member payments based upon member deliveries to each independent pool. The design of the pool structure (single vs. multiple, aggregated vs. quality differentiated) combined with alternative per unit retain amounts could be used as selective incentives to reward and/or penalize member level management decisions that impact the quantity and quality of the production delivered to the cooperative.

4.2.2.5. Non-Member Business: Many cooperatives have begun purchasing from or selling to non-members in order to gain from economies of scale. The U.S. Internal Revenue Service has ruled that the profits created from non-member business are taxable at the cooperative level, whether it is allocated to members proportional to use or not. If profits from non-member business are allocated to members, they are taxed at the member level again. In order to avoid this double taxation, most cooperative leaders have placed these funds into an unallocated reserve. Because these net revenues are not allocated they are also not redeemed, so the unallocated reserve becomes a source of

"permanent" equity for the cooperative.[21] Thus, non-member earnings are not used directly to create selective incentives, but rather indirectly to reduce the equity required by member/patrons and/or shorten the time that retained allocations are held.

4.2.2.6. Dividend Payments: Agricultural cooperatives are allowed to pay dividends proportional to investment, just as a corporation. However, in most cases these dividend payments are taxed at both the cooperative and the member level[22]. And, the state level cooperative incorporation statutes, as well as the Capper-Volstead Act[23], place an upper limit on the amount of these dividend payments. Eight percent is the most common limit placed on dividend payments. Therefore, very few cooperatives use dividends on equity as a selective incentive.

4.2.2.7. New Generation Cooperatives: The past 15 years has seen the growth of an alternative cooperative organizational structure that is commonly referred to as a New Generation Cooperative (NGC). The NGC maintains the same basic net income allocation and distribution policies found in traditional cooperatives, but have instituted a closed membership policy which links patronage to direct equity investment and allows the combined delivery/equity rights to be traded. During formation, a NGC sells equity shares that are proportionally linked to a member marketing agreement. The member marketing agreement contains the right and the obligation to deliver a specified amount of raw agricultural commodities to the cooperative, usually for processing into an

[21] There have been a few cases where cooperatives have allocated and redeemed equity initially placed in an unallocated reserve. However, this is considered a taxable event and the member must pay income tax on the amount that is distributed.
[22] If the cooperative has Section 521 status, dividend payments are taxed only once, at the member level.
[23] The Capper-Volstead Act provides agricultural cooperatives limited exemptions from federal anti-trust violations. Agricultural producers are allowed to joint together and collectively bargain and set prices if they either 1) limit dividends on equity to less than 8% or 2) adopt a one vote per member governance. Membership within these organizations is limited to agricultural producers only.

intermediate or consumer ready product, for the duration of ownership. There is a limited number of combined equity/delivery shares sold. Once the cooperative is formed, the equity/delivery shares are tradable and appreciable. Therefore, if a non-member wants to become a member, they must purchase the equity/delivery shares from an existing or exiting member. The market liquidity for these combined equity/delivery shares is very low relative to publicly traded corporations and is heavily influenced by the specific delivery requirements listed in the member marketing agreement. The NGCs have maintained the one vote per member control policy.

At the end of each fiscal year, the NGC allocates and distributes the cooperative's net income to its members, proportional to patronage, using one of the methods discussed previously. However, because there is a fixed relationship between equity investment and patronage, the conflicting investment and patronage incentives discussed by Cook have been significantly reduces.

If the NGC goes through a rapid growth phase, and the cooperative needs to access capital faster than can be accumulated through retained earnings, it can sell additional equity/delivery shares. Most NGCs have adjusted the relationship between the equity investment and delivery requirements to reflect the change in estimated market value at the time of the new issue (ex. $10.00 equity investment/unit delivered at formation is adjusted to $12.50 equity investment/unit delivered for new issue).

4.3. Summary

Agricultural cooperatives have been described as user owned and controlled organizations that are focused on creating user benefits, and are commonly identified as a form of collective action. These user benefits can be created and realized at both the cooperative firm level and the farmer member level. Some cooperatives create a large portion of their total member value in the form of more competitive local markets, which can be viewed as a public good. Free riding by cooperative members is often discussed by both researchers and cooperative leaders as a challenge facing cooperative business organizations. And, cooperatives utilize a wide range of alternative policies to determine membership, assign control rights and assign rights to residual claims from business activities which have the potential to be used as selective incentives which reward or penalize member actions. Thus, agricultural cooperatives provide a rich environment to study the issues confronting collective action, the challenges created by free riding actions and alternative methods to mitigate free riding.

Chapter 5

Research Method & Survey

Identifying and measuring free-riding behavior is a significant challenge facing both collective action groups and researchers. Within models of free-riding, the individual is viewed as a decision maker who acts within the environment created by the collective action organization's rules. This study focuses on the members' free riding actions and behavior and the policies that provide incentives to mitigate free riding. As such, the unit of analysis is the organization which establishes and enforces the rules, while the unit of measure is the individual. The sections of this chapter discuss the analytical tools used to test the study's objectives in which the agricultural cooperative is chosen as the unit of analysis and the survey is used to collect member level data for analysis.

5.1. Latent Variable Models

Free riding behavior is difficult to directly observe and measure. The latent nature of an individual's actions is explicitly recognized as a core concern within the theoretical representations of large group collective action and unsupervised team production. This study utilizes Structural Equation Modeling (SEM) techniques to confront these issues and test the study's hypotheses.

SEM refers to a family of techniques found under a variety of alternative headings, which include; causal models, latent variable models, models with unobserved variables, analysis of covariance structure and structural modeling. These models are

also sometimes referred to by the names of the computer software programs that are used for the analysis, which include: Mx, Mplus, LISREL, EQS, CALIS and Amos.

This study uses two closely related latent variable techniques. The first is Confirmatory Factor Analysis (CFA), in which latent constructs and their inter-correlations are tested, and the second are structural models, in which causal effects are tested between latent constructs. This section begins with a discussion of the core concepts of CFA and then builds on these concepts as they are applied to structural models.

5.1.1. Confirmatory Factor Analysis (CFA):

The first research question within this study asks whether there are multiple member free riding actions and/or behaviors that coexist within the large marketing cooperative under analysis. To test this hypothesis, a confirmatory factor analysis (CFA) model was constructed. Within CFA, the researcher specifies relationships between manifest variables based upon theoretical justification, and then tests how well the relationships assumed in the model reproduce the observed relationships in the data.

A path diagram, such as the one in Figure 1, provides a visual depiction of the relationships assumed in the model. By using a series of *tracing rules*, a path diagram can be transformed into the underlying linear equations used within the estimation process[24]. Circles or ovals represent latent or unobservable variables, while squares represent manifest or observable variables. Single headed arrows represent the flow of causation from one variable to another, while double headed arrows (not used in Figure

[24] See Loehlin (2004) for a description of the tracing rules originally proposed by Wright (1920) and a discussion of the relationship between a path diagram and the equations used to estimate the implied variance/covariance matrix.

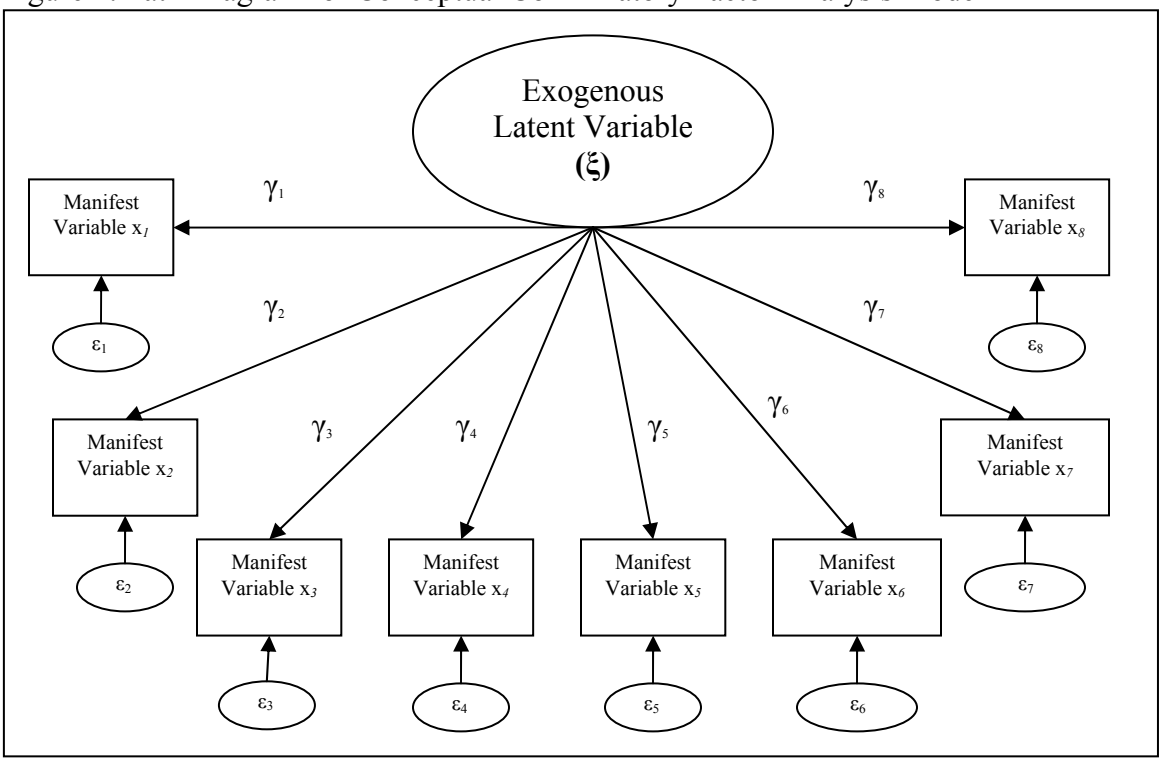
1) represent either a correlation or covariance between variables or a variance if the double headed arrow begins and ends on the same variable.

Figure 1 is a path diagram representation of a CFA model with one latent variable (ξ) and eight manifest variables (x_1 to x_8). The single headed arrows, labeled γ_1 to γ_8, represent the flow of causation from the independent latent variable to the dependent manifest variables. The coefficients, γ_1 to γ_8, are estimated factor loadings from the latent variable to the manifest variables and are interpreted as linear regression coefficients,

Conceptually, the latent variable has a direct effect on the manifest variables. Thus, the variance of each manifest variable and the common co-variation between the manifest variables is assumed to be a direct result of the unobservable latent variable. Because of this relationship, some authors have used the term *measurement or indicator variables* to describe the role the manifest variables perform in the model. Thus, a CFA model allows for multiple indicators or measures to be used for one common construct, and is the reason a CFA technique was chosen as the analytical tool to test the first hypothesis.

Because manifest indicator variables are endogenous, there is a latent error term associated with each variable, symbolized by the small circles labeled ε_1 to ε_8. These error terms represent both the measurement error of the respective manifest variable and the variance of the manifest variable not associated with the latent variable.

Figure 1: Path Diagram for Conceptual Confirmatory Factor Analysis Model



The CFA model in Figure 1 can also be presented in matrix form as:

Equation 1: $x = \Gamma\ \xi\ + \varepsilon$

$$\begin{bmatrix} X_1 \\ X_2 \\ X_3 \\ X_4 \\ X_5 \\ X_6 \\ X_7 \\ X_8 \end{bmatrix} = \begin{bmatrix} \gamma_1 \\ \gamma_2 \\ \gamma_3 \\ \gamma_4 \\ \gamma_5 \\ \gamma_6 \\ \gamma_7 \\ \gamma_8 \end{bmatrix} \begin{bmatrix} \xi \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \\ \varepsilon_4 \\ \varepsilon_5 \\ \varepsilon_6 \\ \varepsilon_7 \\ \varepsilon_8 \end{bmatrix}$$

$x \qquad \Gamma \quad \xi \qquad \varepsilon$

In this equation $\boldsymbol{x}$ is a p x 1 vector of manifest indicator variables, $\boldsymbol{\Gamma}$ is a p x m matrix of unknown factor loadings, ξ is a m x 1 vector of exogenous latent variables and $\boldsymbol{\varepsilon}$ is a p x 1 vector of latent errors. Because there is only one latent variable within this model, $m = 1$.

In order for a solution to be calculated, a CFA must be both logically and mathematically identified. Logical identification requires that the model must have at least as many unique values within the variance/covariance matrix of manifest variables as there are *free*, or estimated, parameters within the model.

If the number of free model parameters equals the number of unique variance/covariance elements, the model is considered *just identified* and there is only one set of unique values that exist for the free parameters. However, if there are fewer unique variance/covariance elements than free model parameters, the model is *under identified* and there are an infinite number of possible free parameter estimates so there is no unique solution for the model. The most common modeling situation is where there are several manifest indicators used to measure latent variable attributes so there are more unique variance/covariance elements than free parameters and the model is considered *over-identified.*

The difference between number of unique variance/covariance elements and the number of free parameters is the model degrees of freedom. The model degrees of freedom are needed to calculate many of the alternative statistics used to measure model fit.

There are 36 unique values within the variance/covariance matrix of manifest variables for the model in Figure 1 (eight diagonal variance terms and 28 unique covariance terms). There are a total of 25 parameters that could be estimated within this

model (eight error variances, eight factor loadings between each latent error variable and the respective manifest variable, eight factor loadings between the main latent variable and each manifest variable and one main latent variable variance). However, nine of these parameters must be fixed to a constant in order to be mathematically identified. So this model actually has 16 free parameters that can be estimated. Thus, this model is over identified (36 > 16) and has 20 degrees of freedom (36 – 16).

To be mathematically identified nine potentially free parameters must be fixed to a constant value. For the latent error terms, either the error variances or the factor loadings between the error term and the respective manifest variable must be fixed to a constant value. A value of one is usually chosen to make the interpretation of results more straightforward. In most cases, the factor loadings are set equal to one so that an error variance value can be estimated.[25]

For the main latent variable (ξ), either the variance of the latent variable or one of the factor loadings for a manifest variable must be fixed, again usually set equal to one. If the variance of the main latent variable is fixed to one, the latent variable has been standardized and does not have a specific unit representation. This allows factor loadings to be estimated for each of the manifest indicator variables.

If one of the factor loadings is set equal to one, the chosen manifest variable becomes the reference variable[26]. This allows the variance of the latent variable to be

[25] If the error variance is set equal to one, the estimated factor loading between the latent error term and the manifest variable is the estimated standard deviation of the error term.
[26] The general recommendation is to first constrain the latent variable variance to one and determine which manifest indicator variable has the highest standardized factor loading, then use that variable as the reference variable.

estimated. The choice of constrains (latent variable variance or factor loading) does not affect overall model fit.[27]

Once the model is both logically and mathematically identified the free parameters can be estimated. Maximum Likelihood estimation is the most commonly used technique to estimate both CFA and structural model free parameters. Although a detailed presentation of Maximum Likelihood estimation is beyond the scope of this study, the concept is relatively straightforward.

The design of the CFA model specified by the researcher defines a set of linear equations that are used to calculate an implied variance/covariance matrix for the manifest variables. The key missing values within these equations are the unknown factor loadings (γ_1 to γ_8). Initial factor loading values, referred to as *start values*, are chosen and an implied variance/covariance matrix is calculated. This implied variance/covariance matrix is then compared to the observed variance/covariance matrix, calculated from the data set, to determine the degree of discrepancy. Small changes are sequentially made to each of the initial start values to determine if the discrepancy between the implied and observed variance/covariance matrices increases or decreases. This process is continued until the difference between the implied and observed variance/covariance matrices is minimized.

[27] *Constraint Interaction* is the term applied when choice of constraint does influence model fit, but this seldom occurs. See Kline (2005) for a discussion of this problem and the conditions that can cause constraint interactions to occur.

There are three key assumptions that are made within the estimation process; they are (Mueller, 1996):

1) Means of the observed and latent constructs are zero.[28]

2) Relationships between the observed variables and the latent constructs are linear.

3) Measurement errors ε, discussed in Equation 1, have a mean of zero and constant variance across observations, are independent (i.e. uncorrelated across observations) and are uncorrelated with the latent variable.

One additional assumption required to estimate standard errors for parameter values and fit statistics is that all endogenous variables are multivariate normal.

5.1.2. Structural Models (SM):

CFA models can include single or multiple latent variables; however, the relationship between multiple latent variables is typically limited to correlation. In contrast, *structural models* contain hypothesized direct effects, or a causal relationship, between latent variables[29]. Latent variable models with direct effects between latent variables are also commonly referred to as Structural Equation Models (SEM). However, as noted above, SEM is also used to represent a family or group of latent variable models. Therefore, this study will use the term Structural Models (SM) to represent models with direct effects between latent variables to reduce confusion.

SMs must also be both logically and mathematically identified and typically Maximum Likelihood estimation is used to calculate free parameter values. However, there are additional parameters and equations present within a SM. Figure 2 is a path

[28] Mueller's presentation utilizes a deviation score matrix rather than a raw score matrix so the mean of the adjusted manifest variables is zero. Some CFA models do include a mean structure.
[29] Structural models can also contain reciprocal rather than unidirectional causal flows. If a model contains only unidirectional causal flows between variables it is referred to as r*ecursive*. If the model contains reciprocal causation between variables it is referred to as *non-recursive*.

diagram for a four factor SM. In this model, there is one endogenous latent variable (η) which has six manifest indicator variables (y_1 to y_6) and four exogenous latent variables (ξ_1 to ξ_4) with three manifest indicator variables each (x_1 to x_{12}).

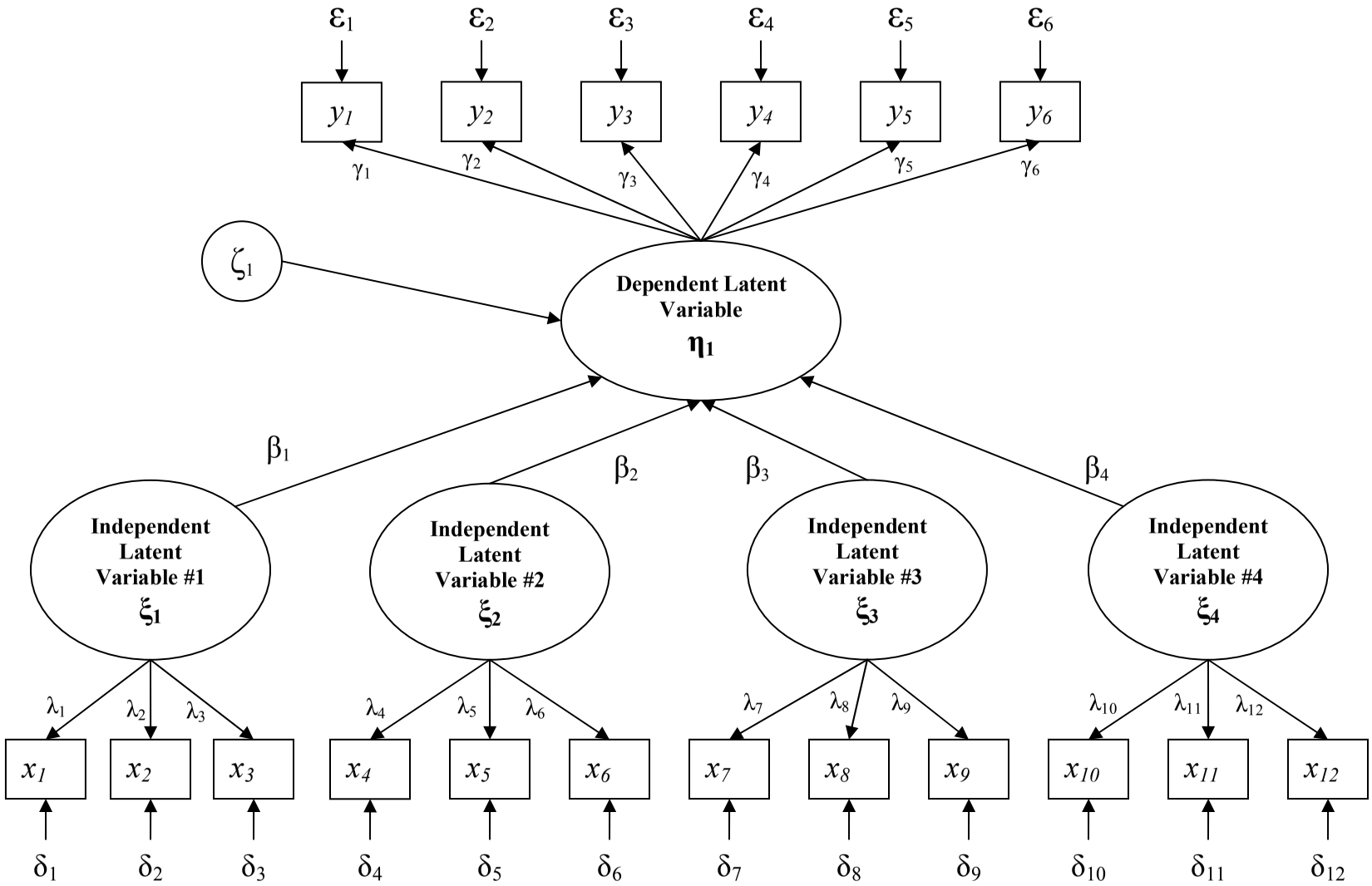
Equation 2 is the measurement equation for the exogenous latent variables (ξ_n) where $\boldsymbol{x}$ is the p x 1 vector of manifest indicator variables, $\boldsymbol{\Lambda_x}$ is the p x m matrix of factor loadings, $\boldsymbol{\xi}$ is the m x 1 vector of exogenous latent variables and $\boldsymbol{\delta}$ is the p x 1 vector of latent errors.

Equation 2: $\boldsymbol{x} = \boldsymbol{\Lambda_x}\,\boldsymbol{\xi} + \boldsymbol{\delta}$

$$\begin{bmatrix} x_{11} \\ x_{12} \\ x_{13} \\ x_{21} \\ x_{22} \\ x_{23} \\ x_{31} \\ x_{32} \\ x_{33} \\ x_{41} \\ x_{42} \\ x_{43} \end{bmatrix} = \begin{bmatrix} \lambda_1 & 0 & 0 & 0 \\ \lambda_2 & 0 & 0 & 0 \\ \lambda_3 & 0 & 0 & 0 \\ 0 & \lambda_4 & 0 & 0 \\ 0 & \lambda_5 & 0 & 0 \\ 0 & \lambda_6 & 0 & 0 \\ 0 & 0 & \lambda_7 & 0 \\ 0 & 0 & \lambda_8 & 0 \\ 0 & 0 & \lambda_9 & 0 \\ 0 & 0 & 0 & \lambda_{10} \\ 0 & 0 & 0 & \lambda_{11} \\ 0 & 0 & 0 & \lambda_{12} \end{bmatrix} \begin{bmatrix} \xi_1 \\ \xi_2 \\ \xi_3 \\ \xi_4 \end{bmatrix} + \begin{bmatrix} \delta_1 \\ \delta_2 \\ \delta_3 \\ \delta_4 \\ \delta_5 \\ \delta_6 \\ \delta_7 \\ \delta_8 \\ \delta_9 \\ \delta_{10} \\ \delta_{11} \\ \delta_{12} \end{bmatrix}$$

$\boldsymbol{x}$ $\quad$ Λ_x $\quad$ ξ $\quad$ δ

Figure 2. Path Diagram for Conceptual Structural Model



Equation 3 is the measurement equation for the endogenous latent variable (η_n) where y is the q x 1 vector of manifest indicator variables, $\mathbf{\Gamma}_y$ is the q x n matrix of factor loadings, $\boldsymbol{\eta}$ is the n x 1 vector of endogenous latent variables and $\boldsymbol{\varepsilon}$ is the q x 1 vector of latent errors. In this example n =1; however, it is common to have multiple endogenous latent variables within SMs.

Equation 3: $\boldsymbol{y} = \mathbf{\Gamma}_y \boldsymbol{\eta} + \boldsymbol{\varepsilon}$

$$\begin{bmatrix} y_1 \\ y_2 \\ y_3 \\ y_4 \\ y_5 \\ y_6 \end{bmatrix} = \begin{bmatrix} \gamma_1 \\ \gamma_2 \\ \gamma_3 \\ \gamma_4 \\ \gamma_5 \\ \gamma_6 \end{bmatrix} \begin{bmatrix} \eta_1 \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \\ \varepsilon_4 \\ \varepsilon_5 \\ \varepsilon_6 \end{bmatrix}$$

$$\boldsymbol{y} \qquad \Gamma_y \quad \eta \qquad \varepsilon$$

And finally, Equation 4 is the structural equation which specifies the relationship between the endogenous (η_n) and exogenous latent variables (ξ_m). Within this equation, $\boldsymbol{\eta}$ is the n x 1 vector of endogenous latent variables, $\boldsymbol{\theta}$ is the n x n matrix of coefficients of the effects (i.e. correlation or direct effects) of endogenous latent variables on endogenous latent variables ($\theta = 0$ for the model in Figure 2), $\boldsymbol{\beta}$ is the n x m matrix of coefficients for direct effects of exogenous latent variables on the endogenous latent variables, $\boldsymbol{\xi}$ is the m x 1 vector of exogenous latent variables and $\boldsymbol{\zeta}$ is the n x 1 vector of residuals, or error in the structural equation. Like the factor loadings, the coefficients for the direct effects between latent variables, β_1 to β_4, are also interpreted as linear regression coefficients. As a reminder, this example contains one endogenous latent variable and four exogenous latent variables, so n = 1 and m = 4.

Equation 4: $\boldsymbol{\eta} = \boldsymbol{\theta}\,\boldsymbol{\eta} + \boldsymbol{\beta}\,\boldsymbol{\xi} + \boldsymbol{\zeta}$

$$\eta_1 = \begin{bmatrix} \beta_1 & \beta_2 & \beta_3 & \beta_4 \end{bmatrix} \begin{bmatrix} \xi_1 \\ \xi_2 \\ \xi_3 \\ \xi_4 \end{bmatrix} + \zeta_1$$

$$\boldsymbol{\eta} \qquad \boldsymbol{\beta} \qquad \boldsymbol{\xi} \quad \boldsymbol{\zeta}$$

There are seven key assumptions made to calculate free parameter estimates within a SM, three of which are the same as the CFA model. They are (Mueller, 1996):

A) The exogenous and endogenous latent variables have a mean of zero.

B) The structural relations from the exogenous to the endogenous latent variables are linear.

C) The error terms in the structural equation ($\boldsymbol{\zeta}$ in Equation 4) have a mean of zero and a constant variance across observations, are independent (i.e. uncorrelated across observations) and are uncorrelated with the exogenous latent variable(s).

D) The matrix ($\boldsymbol{I} - \boldsymbol{\theta}$) is nonsingular (i.e. the matrix is invertable).[30]

E) The means of the exogenous and endogenous observed variables are zero.[31]

F) The relationship between the respective indicator variables and the latent variables (both endogenous and exogenous) is linear.

G) The measurement error terms in $\boldsymbol{\delta}$ (Equation 2) and $\boldsymbol{\varepsilon}$ (Equation 3) have a zero mean and a constant variance across observations, are independent (i.e. uncorrelated across observations), are uncorrelated with the endogenous and exogenous latent variables and are uncorrelated with each other.

Once again, initial start values are chosen for all free parameters and one of the iterative maximum likelihood estimation procedures are used to minimize the difference between the implied and observed variance/covariance matrices of manifest variables.

[30] The matrix $\boldsymbol{I}$ is the identity matrix. Once again, $\boldsymbol{\theta}$ is zero for the example used within this section.
[31] Mueller's presentation utilizes a deviation score matrix rather than a raw score matrix so the mean of the adjusted manifest variables are zero.

5.1.3. Model Fit Indices:

The family of SEM techniques currently does not have a single measure which satisfies all the desired characteristic for assessing overall model fit, thus a group of model fit indices are recommended. Although there are a variety of alternative model fit indices that are currently available, the Model Chi-Square, Root Mean Square Error of Approximation (RMSEA), Akaike Information Criterion (AIC), Normed Fit Index (NFI), Comparative Fit Index (CFI) and Goodness of Fit Index (GFI) are the most common found within the literature. Table 6 provides the formulas used to estimate these indices and the recommended values for determining general model fit. These model fit indices are used to test both CFA and SMs.

Table 6: Selected Structural Equation Model Fit Indices with Formulas and Recommended Values.[1]

Measure of Fit	Abbreviation	Formula[2]	Recommended Values
Model Chi-Square	χ^2_m	$\chi^2_m = (n-1)\hat{C}$	H_o: $\chi^2_m = 0$ If fail to reject H_o, then model has good fit. No general recommended value. Sensitive to sample size.
Root Mean Square Error of Approximation	RMSEA	(F_o / d)	0.05 or less = close fit 0.05 ≤ value ≤ 0.08 = good fit Value ≥ 0.10 poor fit
Akaike Information Criterion	AIC	$\hat{C} + 2q$	Used to rank nested models with same structure. Smaller values indicate better fit.
Normed Fit Index	NFI	$1- (\hat{C} / \hat{C}_b)$	0.90 or greater = good fit
Comparative Fit Index	CFI	$1- (F_o / F_b)$	0.90 or greater = good fit
Tucker-Lewis Index	TLI	$(\hat{C}_b/d_b - \hat{C}/d) / (\hat{C}_b/ d_b - 1)$	0.95 or greater = superior fit

1 The notation and formulas used for the fit indices are from Arbuckle (2005) and Kline (2005). The recommend values are from Arbuckle (2005), Loehlin (2004), Kline (2005) and Mueller (1996).
2 $\hat{C}$ = CMIN = minimum value of the discrepancy function C, d = model degrees of freedom, d_b = baseline model degrees of freedom, $F_o = \max((\hat{C}-d)/n),0)$ = estimated noncentrality parameter/n, q = number of unknown parameters being solved for, $\hat{C}_b = \hat{C}$ for baseline model (Amos 6.0 uses the independence model as the baseline), F_b = estimated noncentrality parameter for baseline model, V_r = unexplained variability in sample covariance matrix, V_t = total variability in sample covariance matrix.
.

5.1.4. Cautions when using Structural Equation Modeling.

Kline (2005) lists a variety of cautions for researchers that use the latent variable or structural equation modeling techniques discussed above. Many of these issues are shared with other statistical analysis techniques like multiple linear regression. However, there are six cautions that are especially relevant for latent variable or structural equation modeling techniques, and will be discussed in random order.

The first is to carefully consider the question of directionality. Directionality refers to the researcher's explicit statement about the expected sequence of causation. Structural models provide a researcher considerable flexibility to explicitly model both direct and indirect effects. For example, a researcher could specify two alternative models. In the first model, variable *x* is assumed to be one of several variables that have a direct effect on variable *y* (i.e. $y = f(x,a,b)$). And, variable *z* is assumed to have a direct effect on variable *x* (i.e. $x = f(z)$). Therefore, variable *z* has an indirect effect on variable *y* by acting through variable *x*. The model could also be specified such that both variables *x* and *z* have direct effects on variable *y* (i.e. $y = f(x,z,a,b)$). These two models make very different statements about the sequence of causation between variables. All explicit statements of causation specified in the model should be firmly grounded in theory.

A second caution is adding correlations between disturbance or measurement error terms without justification. This refers to the researcher adding a correlation (i.e. double headed arrow) between the error terms of two manifest indicator variables. In some cases, including correlated errors will significantly improve the model's overall fit statistics. This addition will also influence the estimated factor loadings for these variables. The researcher should provide a reasonable justification for adding correlated error terms, other than simply improving model fit.

The third caution is to evaluate multiple model fit indices when appraising overall model fit. This was discussed above and the most commonly cited fit indices were defined.

A fourth caution is not to interpret good overall model fit as "proof" that the model accurately represents reality. Although this caution also applies to other statistical techniques, it is especially relevant for structural models because it is possible to construct alternative models that have nearly equivalent overall fit statistics. Although equivalent models are not common, the researcher must be alert to the potential for alternative model specifications with different statements about causation and correlation that can result in similar overall fit statistics.[32]

The fifth caution is not to be ensnared in the "naming fallacy". Assigning names to latent variables is done for convenience. It is the manifest indicator variables used to measure the underlying construct which defines the latent variable. Therefore, it can be easy to assign a name to a latent variable that does not appropriately represent the set of indicator variables.

The final caution is not to interpret large estimated direct effects as "proof" of causality between the variables. Even though large estimated direct effects from a well designed and implemented research study can show strong support for a causal relationship, it does not prove causation. True causality is difficult to prove with a single model from a single study, especially using cross sectional data.

5.2. The Cooperative Selected for Analysis

As mentioned earlier, agricultural cooperatives have been identified as one type of collective action organization and member free riding has been discussed by researchers and cooperative leaders as a challenge facing many cooperatives. However, as Cook and Iliopoulos found, not all cooperatives face the same degree of investment based free

[32] See Klein (2005) and Loehlin, (2004) for a more complete discussion of equivalent models.

riding. Thus, if agricultural cooperatives are to be used to study alternative forms of free riding behavior and potential methods to mitigate this behavior the choice of alternative business models must be made carefully.

There were six criteria that were identified and used to select a cooperative business for this study. The six criteria were:

1) A large membership base.
2) A primary business object to create a collective good with public good attributes.
3) An open membership policy with very few entry and exit barriers.
4) Utilization of a centralized rather than federated organizational structure.
5) Incorporation of a variety of organizational policies which have the potential to mitigate free riding behavior.
6) Indication of support for the research efforts.

Based upon these criteria, the cooperative chosen for this study was United Producers, Inc. (UPI). UPI is a livestock marketing cooperative, headquartered in Columbus, Ohio, which owns and operates 19 weekly livestock auctions and 23 animal collection points for direct livestock movement within six states[33]. It provides local market outlets for beef cattle, dairy cattle and replacement heifers, hogs, sheep and goats. In 2005, UPI handled 2,834,607 head of livestock and had a total sales volume of $799,433,551[34]. The cooperative also provides farmers access to agricultural loans, price risk management services and production consulting services.

[33] Ohio, Illinois, Indiana, Missouri, Michigan and Kentucky.
[34] 2005 United Producers Inc. annual review.

UPI has a large membership base with 51, 423 individual farmers or farm entities listed as patron/members in 2005. UPI's parent cooperative was originally formed to "provide livestock producers access to competitive markets", which continues to be the central theme within their current mission statement[35]. This objective is consistent with Nourse's view that the primary objective of a cooperative is to act as a competitive yardstick.

UPI also has an open membership policy with very few entry and exit barriers. To become a general member, an individual must be a producer[36] and market at least one animal per year through any of the livestock auctions or direct movement collection points. There are no long term marketing contracts required for membership. Thus, an individual is free to market as many, or as few, animals through the cooperative at any time they choose. UPI does offer to arrange short term or long term marketing contracts with livestock buyers or processors as a service to their members. However, UPI only acts as an agent to arrange the contracts and the contracts are not required for membership.

UPI has a centralized, rather than federated, organizational structure where the producer is a direct member of the cooperative. The cooperative's senior management and the board of directors also recently completed a major review of their organizational structure and membership polices, and made several changes to these policies. A discussion of the current membership policies will be provided below. And finally,

[35] Personal discussion with Dennis Bolling, President & CEO of United Producers Inc.
[36] UPI's by-laws define a producer as "a person (natural or corporate) engaged in agricultural production for the market, including tenants of land who use such land for agricultural production and users of land who receive as rent part of the agricultural products from such land."

UPI's leadership supports the study's research objective and hopes the results might inform member policy decision making for the cooperative leaders.

Given the above criteria, United Producers Inc. provides an organizational structure and economic environment that is favorable for studying all three potential dimensions the free rider problem; exclusion based, measurement based and interaction based free riding.

5.2.1. Review of UPI's Membership Policies:

UPI's senior management and the board of directors recently completed a major review of the cooperative's organizational structure and membership policies. This review included the possible conversion from a cooperative business structure to a privately held corporation, a limited liability company or an employee owned firm. The decision was made to continue operating as a cooperative, but to modify the membership polices and introduce a two tiered membership structure.

This major review was initiated while preparing a Chapter 11 bankruptcy reorganization plan. The reason of the Chapter 11 filing was to provide an environment to deal with litigation resulting from the Young and McConnell fraud activities. In 1999, Producers Livestock Association merged with MFA Livestock Association (MFA-LA) to create United Producers Inc. At the time of the merger, MFA-LA passively owned 75 percent of MFA Livestock Services, LLC (LLC) with the remaining 25 percent being owned by Professional Business Services, Inc (PBS). PBS was the managing partner and jointly owned by George Young and Kathleen McConnell. After the merger that created UPI, UPI remained a passive investor and was not involved in the regular business operations of the LLC. In August of 2001, PBS unexpectedly filed for Chapter 7

bankruptcy protection. Young and McConnell were later indicted and pleaded guilty to several charges of fraud. As a result of their ownership interests in the LLC, UPI was also named in several of the law suits surrounding the fraud charges. UPI's Chapter 11 filing allowed the cooperative to maintain regular business operations with its members during the court proceedings. UPI's reorganization plan was accepted in October of 2005, seven months after the initial filing, and was fully supported by all of its major creditors[37].

Formulating a reorganization plan provided the board of directors and management an opportunity to carefully reevaluate the company's organizational form (i.e. cooperative, corporation, limited liability company or employee owned firm), its structure (open membership, closed membership, federated or centralized) and its policies. The remainder of this section reviews the current cooperative by-laws and member policy structure.

5.2.1.1. Voting versus Non-voting Members: As mentioned previously, to become a general member of UPI a producer must sell livestock, on an annual basis, through one of the cooperative's auction facilities or delivery sites. This entitles the producer to receive their proportional share of the cooperative's allocated net income.[38] However, to establish voting rights to elect district delegates, on a one vote per member basis, a producer must market a minimum of 20 head of livestock per fiscal year.[39]

5.2.1.2. District Delegates: UPI's by-laws require the board of directors to establish no less than 12 and no more than 25 regional districts. Within these districts,

[37] Amended Joint Disclosure Statement of United Producers , Inc. and Producers Credit Corporation. Untied States Bankruptcy Court for the Southern District of Ohio Eastern Division. Case No. 05-55272.
[38] Income from Producers Credit Corporation, a lending cooperative subsidiary of UPI, is placed into an unallocated reserve rather than being allocated to members marketing livestock products.
[39] UPI's fiscal year is from January 1 to December 31.

general members elect peers to serve as district delegates who are the legal "voting members of the association" and have the authority to elect the board of directors and vote on changes to the cooperative's articles of incorporation and by-laws.

Each district can have no less than 10 and no more than 20 delegates representing a single district. Each district can elect one representative to serve on the cooperative's board of directors. UPI currently has 16 districts, 223 district delegates and 16 members on the board of directors. Both district delegates and board of directors serve three year revolving terms and maintain the one vote per member policy.

This district voting structure creates a type of federated voting configuration. So, although UPI does not have a federated business structure, where individuals are members of independent cooperative businesses which are in turn members of larger a federated cooperative, there is a federated representation system.

5.2.1.3. Preferred Members: One of the changes instituted as part of the reorganization plan was to create a second class of membership termed a *preferred membership*. To become a preferred member, a producer must market a minimum of 20 head per fiscal year through the cooperative and pay a $20 per year preferred membership fee. Preferred membership allows members access to 1) a ten percent discount on tariff schedules at auction facilities, 2) direct, or non-auction, marketing services and 3) management and consulting services, risk management services, producer training and certification and financial services. Additional fees are required to perform the marketing, management and training services, but they are only available to preferred members. The preferred membership fee is automatically subtracted from the first

livestock sales check of the year. If a producer does not want to be a preferred member, they must complete a reimbursement form to request a refund.

5.2.1.4. Per Unit Capital Retains and Equity Redemption: Another change initiated as part of the reorganization plan was to introduce a per unit capital retain policy. For every head of livestock a member markets through the cooperative, a fixed fee is withheld from the sales check as the member's contribution to the cooperative's equity capital. There is a $0.75/head capital retain for cattle, a $0.25/head retain for swine, sheep and goats and a $0.50 head retain for any other species marketed. This equity contribution does not bear interest or receive a dividend.

After a five year period retained equity, both per unit capital retains and allocated retained net income, is returned to the member at book value on a revolving basis.[40] The five year equity revolvement policy was instituted before the reorganization plan. There is also an upper limit of $2,500 per member on total accumulated retained investment at any time during the five year period.

5.2.1.5. Producers Credit Corporation: Producers Credit Corporation (PCC) is a wholly owned stock cooperative subsidiary of UPI. PCC provides financing to agricultural producers within UPI's trade area and had an outstanding loan volume of $47,117,359 in 2005. PCC provides lines of credit for crop and livestock operations as well as financing for the purchase of breeding livestock, feeder livestock, farm machinery and equipment, livestock facilities and barns and real estate.

A borrower does not need to be a member of UPI to obtain credit from PCC, but the vast majority of PCC customers are UPI members. If a preferred member takes out a

[40] According to UPI's by-laws, the only time per unit capital retains and retained allocated patronage would not be returned at book value would be if net business losses were in excess of the unallocated reserves and member equity was required to off set the loss.

loan from PCC to purchase feeder livestock and agrees to market the finished animals through UPI, the interest rate on the feeder livestock loan will be reduced by 25 basis points.

5.2.1.6. Selective Incentives Created by UPI By-Laws and Member Policies:

Each one of the proceeding member policies and by-law provisions can be viewed as creating a form of selective incentive. By marketing livestock through the cooperative and becoming a member, a producer has access to potential patronage allocations. A portion of these allocations will be in cash and the rest retained and revolved after five years. For most cooperatives, the cash portion of the patronage allocation is just enough to pay the federal and state income taxes that are due on the total allocation. Thus, the discounted value of the retained allocation would be a reasonable estimate of the net financial benefit realized by allocated cooperative net income.

By marketing a minimum of 20 head per year the member gains the ability to elect peers as district delegates and to serve as a district delegate if elected. This adds a set of limited control rights to the rights to residual claims available to general members.

If the voting member accepts the automatic $20 per year preferred membership fee, they gain access to a broader range of information and services. Many of these services, like access to information regarding local or regional market conditions and buyer preferences, could be classified as club goods because the preferred membership status is used as an institutional exclusion mechanism. Other services, like assistance in locating, purchasing and delivery of feeder pigs to a member with a hog finishing unit, would be classified as private goods which could be used as an incentive to increase cooperative patronage levels.

In contrast, the per unit capital retain process and retained allocated patronage can be viewed as a form of coercion initiated by UPI because they are not discretionary equity contributions by the member and the member cannot access these retains before the five year period has expired.

The combination of differentiated per head retain amounts, relatively short five year revolving redemption plan and $2,500 per member limit on accumulated investment also reduces the potential for the user versus investor conflicts discussed by Cook. Those producers who are high patronage members and utilizing the cooperative's facilities the most are also the ones who are providing a proportionally larger amount of the equity capital. This maintains a loose balance between patronage and investment. The differentiated per head retain amounts reduces the potential that equity retained from marketing one livestock species will be used to cross subsidize the investment required to market another species, assuming that the relative retain amounts for each species are appropriate.[41]

The relatively short equity redemption period reduces the potential conflict between new cooperative patrons and long term patrons because it will take five years for new members to be proportionally invested with long term members. However, the five year revolvement period does not do as good a job of maintaining a balance between use and investment for producers with high variability in year to year patronage levels.

5.2.1.7. Essential Member Resource Contributions:

There are three main member resources that are essential to ensure that UPI can create collective benefits. The first is patronage, or marketing volume. Although the

[41] UPI's by-laws do allow the netting of losses between business units; therefore, it is still possible that members marketing one species can be cross subsidizing the marketing activities for another species or one business unit subsidizing the activities of another business unit.

specific shape of the collective goods production function is unknown, the cooperative must handle enough animals through its system to capture and maintain economies of scale and scope in marketing, logistics and transportation. The cooperative must also attain sufficient volume to put competitive pressure on other firms in the market.

Second, members must provide the equity investment required to maintain a financially strong business entity. Although UPI's underlying business strategy and operations remained strong during the Chapter 11 reorganization process, the cumulative costs of litigation significantly reduced existing member equity levels. Therefore, there is a need to replenish and sustain the equity base of the cooperative and give it the financial strength to allow future growth.

And third, members must contribute human capital. Members are expected to participate in the corporate governance activities like attending district meetings and electing competent district delegates, serving as a district delegate if elected and serving as a board member if elected. Members also have a responsibility to monitor the activities of management, both at the local/branch level and at the corporate level, if possible, to limit agency costs. In order to effectively monitor management activities and participate in governance activities, the member needs to maintain a basic knowledge of the cooperative's policies, business activities and industry dynamics.

5.3. UPI Membership Survey

The primary data for the study is derived from a mail out – mail back survey. A stratified random sample of UPI members received the survey in July of 2006. Four segments of the membership were identified and surveyed; they were 1) preferred voting

members with patronage exceeding the mean patronage level, 2) preferred voting members with patronage less than the mean patronage level, 3) non-voting members and 4) district delegates.

The stratification process was done to provide a representative sample of the cooperative's membership based upon member business volume rather than number of members. UPI's senior management verified that the membership base was very heterogeneous with respect to the number of head marketed per member through the cooperative. There were a large number of very small producers who marketed only a few head per year. And, there were a relatively small number of commercial producers that accounted for a significant portion of the total business volume done by the cooperative. Therefore, the sample was stratified by patronage level to ensure proper representation of the high patronage voting members.

As mentioned previously, in order to be assigned voting rights for electing district delegates a member must market at least 20 head per year through the cooperative. All members are automatically accessed the $20 per year preferred membership fee. As a result, UPI maintains membership lists for two classes of members; non-voting members and preferred voting members.[42]

To determine the separation between high patronage and low patronage preferred voting members, the mean patronage level was calculated for all preferred voting members based upon the number of head sold during the 2005 fiscal year. The number

[42] Personal conversations with UPI's senior management indicated that 225 members requested a refund of the preferred membership fee in 2005. The members that did request a refund were periodic users who marketed a very small number of head per year.

of hogs, sheep and goats sold were converted to *cattle head equivalents*[43] before the mean patronage level was calculated by UPI's senior management. There were 2178 preferred voting members with patronage exceeding the mean patronage level of 70.3 head per year and 9370 preferred voting members with patronage less than the mean patronage level.

The names of the current 223 district delegates were removed from the list of voting members and the remaining 11,325 preferred voting members were resorted by cattle head equivalents. The 2000 members with the largest volume of head equivalents were classified as *high patronage voting members*. 2000 names were randomly selected from the remaining 9,325 voting members and classified as *low patronage voting members*. 1500 names were randomly selected from the 39,875 non-voting members and classified as *non-voting members.*

After careful review, it was determined that 178 addresses were incomplete and undeliverable by the postal service. A total of 5545 surveys were mailed to UPI members; 1963 to high patronage voting members, 1908 to low patronage voting members, 1451 to non-voting members and all 223 district delegates. Table 7 provides a comparison of the estimated 2005 total cooperative business volume provided by each sampling group and the total surveys mailed to each sampling group.

A total of 575 surveys were returned, which represents approximately 10.4 percent of the total surveys mailed. There were 199 surveys returned from the high patronage voting member classification, 217 returned from the low patronage voting member classification, 99 from the non-voting member classification and 60 from the

[43] A conversion factor of 7 hogs = 1 cattle equivalent and 17 sheep or goats = 1 cattle equivalent was used to calculate a numeric value with a common metric. These conversion factors were calculated by multiplying the typical market sales weight for each species by the five year average prices received, as reported in USDA (2006). The gross market value was then used to estimate the respective conversion factors.

district delegate classification. Table 8 summarizes the survey response rate information by sampling group.

A copy of the survey mailed to UPI members is reproduced in Appendix A. The identical survey was mailed to each sampling group, but the surveys were printed on different colored paper to determine the appropriate classification for each returned survey.

Table 7: Estimated Cooperative Business Volume and Surveys Mailed by Sampling Group

Survey Group Classification	2005 Sales Volume		Surveys Mailed			
	Percentage	Cattle Head Equivalents[1]	Delegates Included in High Patronage Voting Member Group		Delegates Excluded	
			Percentage	Number	Percentage	Number
High Patronage Voting Members	38.2	405,400	39.4	2186	36.9	1963
Low Patronage Voting Members	38.2	405,400	34.4	1908	35.8	1908
Non-Voting Members	23.6	250,139	26.2	1451	27.3	1451
Total	100	1,060,939	100	5545	100	5322

1 A conversion factor of 7 hogs = 1 cattle equivalent and 17 sheep or goats = 1 cattle equivalent was used to calculate a numeric value with a common metric.

Table 8: United Producers Inc. Survey Response Rate by Membership Class.

Survey Group Classification	Total Number of Members Within Class	Number of Surveys Mailed	Number of Surveys Returned	Percent Response Rate	
				Percent of Total Members Within Class	Percent of Surveys Mailed
High Patronage Voting Members	2,000	1,963	199	9.95 %	10.14 %
Low Patronage Voting Members	9,325	1908	217	2.33 %	11.37 %
Non-Voting Members	39,875	1,451	99	0.25%	6.82 %
District Delegates	223	223	60	26.90 %	26.90 %
Total	51,423	5,545	575	1.12 %	10.37 %

Chapter 6

Model Specification and Results

This chapter provides the specifications for the Confirmatory Factor Analysis (CFA) models and Structural Models (SM) used to test the study's two research hypothesis. It also provides the results from the analysis and an interpretation of the model findings. This chapter is divided into two sections, one for each of the research questions and hypotheses.

6.1. Research Question 1

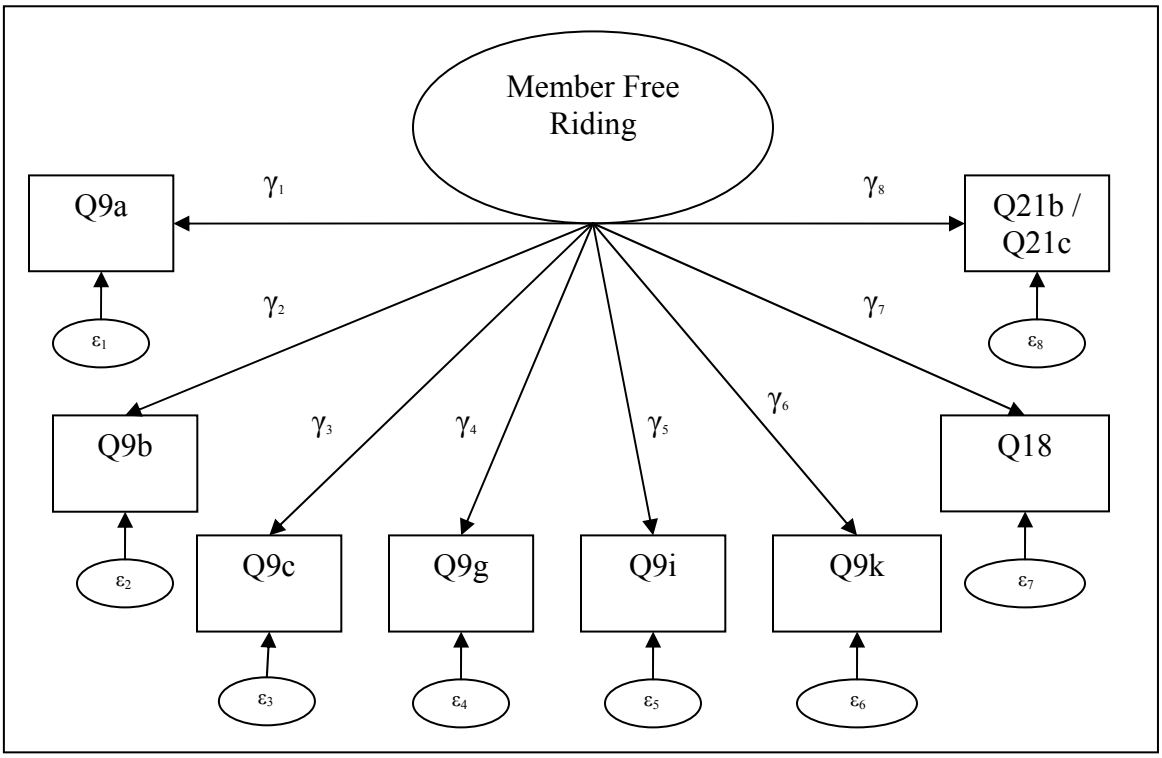
Are there multiple member free riding actions and/or behaviors that coexist within the large collective action organization under analysis?

Hypothesis 1: There are multiple member free riding actions and/or behaviors that coexist within the large collective action organization under analysis.

H_0: There is a single dominant form of member free riding behavior within the large collective action organization under analysis.

To test the first hypothesis a CFA model was designed based upon the exclusion, measurement and interaction based perspectives of free riding identified within the literature. Figure 3 is a path diagram representation of the model used to test the first hypothesis.

Figure 3: Path Diagram for Confirmatory Factor Analysis Model for *Member Free Riding*.



This path diagram representation assumes that there is one common cause, member free riding, for the variation and co-variation of the observed member actions and/or behaviors. In other words, the manifest variables are assumed to be alternative measures of the same underlying, unobservable, concept. Therefore, if the implied variance/covariance matrix for the manifest variables estimated by the model matches the variance/covariance matrix of the same variables within the data set, there is a strong likelihood that the model is an accurate representation of the relationships.

Within this model, the endogenous manifest variables are a vector of questions contained on the United Producers, Inc. (UPI) member survey. Table 9 reproduces the survey questions, lists the number of responses for each Likert scale category, the number

of missing values and the calculated mean and variance for each of the manifest indicator variables. The correlation coefficient matrix for these manifest indicator variables is provided in Appendix C.

The first variable, Q9a (strong supporter), is a self assessment measure of the respondents overall support for the cooperative. The second and third variables, Q9b (consistent patron) and Q9c (best deal member), are used as indicators of repeated interaction with the cooperative, and are analogous to a repeated game setting. Variable Q9b is a self assessment of consistent patronage and variable Q9c measures how sensitive a member's patronage is to changes in relative prices between the cooperative and other firms within the industry, which is used as an alternative measure of consistent patronage.

The fourth variable, Q9g (read information), measures if the member regularly reads information provided by the cooperative concerning its operations and activities, which is one form of communication between the cooperative and its members. Variable five, Q9i (discuss with neighbors), measures if the member regularly discusses the activities of the cooperative with their neighbors, which is analogous to communication between players in a game theory experiment.

Table 9: Member Survey Questions, Number of Responses by Category, Number of Missing Values, and Calculated Mean and Variance Values for Survey Questions Used as Manifest Indicator Variables for the Latent *Member Free Riding* Variable.

Variable[1]	Survey Question	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5	Missing	Mean	Variance
Q9a	I consider myself a very strong supporter of UPI.	6	19	159	256	126	9	3.84	0.71
Q9b	I have consistently patronized UPI over the past 5 years.	5	16	43	223	277	11	4.33	0.65
Q9c	If UPI does not offer the "best deal", I will do business elsewhere.	28	61	150	223	98	15	3.54	1.12
Q9g	I regularly read the information UPI sends me.	18	28	102	320	83	24	3.77	0.78
Q9i	I regularly discuss the activities of UPI with my neighbors.	65	97	176	195	28	14	3.04	1.18
Q9k	I actively monitor the actions of UPI's management and employees.	81	89	205	156	31	13	2.94	1.23
Q18	When you have a concern about how the cooperative is being operated, do you: Do Nothing	Dummy Variable: No = 0; Yes = 1 No = 378 Yes = 139					58	0.27	0.20
Q21b [2]	How many head of livestock were sold or culled in 2005	Calculated Ratio: Q21b / Q21c Continuous Variable from 0.0 to 1.0 1.0 = 134					318	0.799	0.093
Q21c [2]	How many head of livestock were sold/culled through UPI in 2005								

1 Question 9 contained a series of related questions. Each individual question within Question 9 was ordered alphabetically from top to bottom. Question 21 also contained a series of questions. Each individual column within Question 21 was ordered alphabetically from left to right.

2 The number of head for the various species listed in Question 21 were converted to *cattle head equivalents* . A conversion factor of 7 hogs = 1 cattle equivalent and 17 sheep or goats = 1 cattle equivalent was used to calculate a numeric value with a common metric.

Variable six, Q9k (monitor management), measures if the member actively monitors the actions of the cooperative's management and employees. Most UPI members do not have the ability to directly monitor the activities of the cooperative's senior management due to the large membership base and geographic dispersion. However, the members do have the ability to monitor the activities of the management in charge of the local auction facilities and/or delivery locations. The seventh variable, Q18 (contact cooperative), is a dummy variable used to determine if the member contacts individuals within the cooperative when they have a concern about how the cooperative is being operated, and is used as a proxy for conveying preferences.

The final variable, Q21b/Q21c (percent patronage), is a calculated value of the percentage of total animals marketed through the cooperative. This is a measure of the total available member resources that were contributed towards the production of the collective goods.

To summarize, Q18 (contact cooperative) is one measure of exclusion based free riding, Q9k (monitor management) is an indicator of measurement based free riding, while Q9b (consistent patron), Q9c (best deal member) and Q21b/Q21c (percent patronage) are measures of both exclusion and measurement based free riding due to UPI's use of a per unit capital retain plan. While Q9g (read information) and Q9i (discuss with neighbors) are measures of interaction based free riding and Q9a (strong supporter) is a proxy for the overall support for the cooperative.

Amos 6.0 was the latent variable computer software used to perform both the CFA and SM analysis, with the raw score matrix being used to calculate parameter

estimates. Amos utilizes the Full Information Maximum Likelihood (FIML) data imputation method to fill in missing data observations, rather than listwise deletion, pairwise deletion or mean replacement. As long as the *missing at random* assumption holds for the missing observations, Amos will provide both efficient and consistent parameter estimates.[44] This imputation process also requires that a mean structure be added to both the CFA and SM models, which was done.

The last variable in Table 9, Q21b/Q21c, had a very high level of missing observations (55.3 % missing) and was heavily skewed towards 1.0 (134 of the 257 observations equal 1.0). Although FIML is viewed to be an acceptable method for dealing with missing data, it is unclear how effectively the procedure can handle this high level of missing observations. As a result, this variable was converted to a categorical variable containing three categories. The first was *provide full information*, where the survey respondent provided enough information to calculate a percentage of sales value and was recorded as value of two. The second was *provide partial information*, where the respondent provided one of the two values needed to calculate a percentage, and was recorded as a value of one. The final was *missing information*, where the respondent did not provide any information, and was recorded as a value of zero. There were 256 responses in the full information category, 69 in the partial information category and 250 in the missing information category. Due to the conversion process, this variable became a proxy for the willingness of the member to share information with the cooperative.

[44] See Arbuckle (2005) and Wiggings and Sacker (2002) for a discussion the Full Information Maximum Likelihood (FIML) imputation method used by Amos and how FIML compares to other methods for dealing with missing data in latent variable analysis. *Missing At Random* assumes that the missing values are random within the series of observations for that variable, but may be linked to observed values within other variables.

Two additional modifications were made to the initial model presented in Figure 3 during the estimation process. First, a correlation was added between the latent error terms of Q9a (strong supporter) and Q9b (consistent patron). Once again, the latent error term represents both the measurement error of the manifest variable and the variance of the manifest variable not associated with the latent variable. In this case it is reasonable to assume that the measurement errors of these two variables are correlated because they are both self assessment indicators. The second modification was to add a correlation between the error terms of Q9i (discuss with neighbors) and Q9k (monitor management). This can be justified on the basis that a portion of the discussions between neighbors would be related to the actions and performance of the cooperative's management and employees. The estimated correlation between the errors of Q9a and Q9b was 0.409[45], while the estimated correlation between the errors of Q9i and Q9k was 0.323[46]

Table 10 lists the unstandardized factor loadings, standardized factor loadings, estimated standard errors, critical ratios and *P* values for the free riding CFA model in Figure 3, with the added error correlations.

[45] This correlation coefficient had an estimated standard error of 0.029, a critical ratio of 7.25 and a *p* value less than 0.001.
[46] This correlation coefficient had an estimated standard error of 0.053, a critical ratio of 4.749 and a *p* value less than 0.001.

Table 10: Unstandardized Factor Loadings, Standardized Factor Loadings, Estimated Standard Errors, Critical Ratios, and *P* Values for the *Member Free Riding* Confirmatory Factor Analysis Model.

Manifest Variable	Untandardized Factor Loadings	Standardized Factor Loading	Estimated Standard Error	*z* Critical Ratio[1]	*P* Value
Q9a	0.491	0.583	0.041	12.055	***
Q9b	0.291	0.359	0.042	6.993	***
Q9c	-0.178	-0.169	0.053	- 3.336	***
Q9g	0.567	0.642	0.043	13.071	***
Q9i	0.686	0.631	0.054	12.638	***
Q9k	0.604	0.544	0.057	10.606	***
Q18	-0.178	-0.402	0.023	-7.826	***
Q21b/Q21c Categorical	0.019	0.021	0.047	0.406	0.684

*** Indicates a *P* value of less than 0.001 (two-tailed)
1 This model has 18 degrees of freedom

Based upon this model design, all parameter estimates are highly statistically significant with the exception of the categorical variable for providing sales information. This model design was then run with the categorical information variable reclassified into a dummy variable where *full information* was coded as a one and *incomplete information* coded as a zero. This recoded variable was not statistically significant.[47] Therefore, the categorical information variable was dropped from the initial model and the model was re-estimated. Table 11 summarizes the re-estimated model results after the Q21b/Q21c variable was dropped from the analysis. Table 12 summarizes the model fit statistics for the re-estimated CFA model.

[47] The reclassified dummy variable had an unstandardized factor loading of 0.002, a standardized factor loading of 0.003 a standard error of 0.025, a critical ratio of 0.068 and a *p* value of 0.946.

Table 11: Unstandardized Factor Loadings, Standardized Factor Loadings, Estimated Standard Errors, Critical Ratios, *P* Values and Squared Multiple Correlations for the Revised *Member Free Riding* Confirmatory Factor Analysis Model.

Manifest Variable	Untandardized Factor Loadings	Standardized Factor Loading	Estimated Standard Error	*z* Critical Ratio[1]	*P* Value	Squared Multiple Correlation
Q9a	0.491	0.583	0.041	12.065	***	0.341
Q9b	0.290	0.359	0.042	6.987	***	0.129
Q9c	-0.179	-0.169	0.054	- 3.345	***	0.029
Q9g	0.568	0.644	0.043	13.089	***	0.414
Q9i	0.686	0.631	0.054	12.635	***	0.398
Q9k	0.602	0.543	0.057	10.576	***	0.295
Q18	-0.177	-0.400	0.023	-7.789	***	0.160

*** Indicates a *P* value of less than 0.001 (two-tailed)
1 This model has 12 degrees of freedom

Table 12: Selected Model Fit Indices for the Revised *Member Free Riding* Confirmatory Factor Analysis Model.

Fit Index	Estimated Model Value	Recommended Value
χ^2_m	39.417[1]	Value heavily influenced by sample size. No general recommendation
Root-Mean-Square Error of Approximation (RMSEA)	0.063[2]	0.05 or less = close fit 0.05 ≤ value ≤ 0.08 = good fit Value ≥ 0.10 poor fit
Akaike Information Criterion (AIC)	85.417	Used to rank nested models with same structure. Smaller values indicate better fit.
Normed Fit Index (NFI)	0.946	0.90 or greater = good fit
Comparative Fit Index (CFI)	0.961	0.90 or greater = good fit
Tucker-Lewis Index (TLI)	0.909	0.95 or greater = superior fit

1 This model has 12 degrees of freedom. The *p* value was less than 0.001 so H_o is not rejected.
2 90 % confidence interval = 0.042 to 0.086

6.1.1. Interpretation of CFA Model Results:

Each of the individual factor loadings was found to be highly statistically significant. The overall model fit statistics indicate that this model does a good job of describing the total variation and co-variation of the manifest indicator variables and

there is a high likelihood that the latent free riding variable is directly influencing the observed manifest variables.

The standardized factor loadings, which can be interpreted as standardized regression coefficients, allow for a direct comparison across parameter estimates. Based upon this comparison, Q9g (read information), Q9i (discuss with neighbors), Q9a (strong supporter) and Q9k (monitor management) are most heavily influenced by the latent variable and have estimated standardized factor loadings of 0.644, 0.631, 0.583 and 0.543 respectively. While Q18 (contact cooperative) and Q9b (consistent patron) are moderately impacted, with estimated standardized factor loadings of -0.400 and 0.359 respectively. While Q9c (best deal member) was the least influenced, with an estimated standardized factor loading of -0.169.

Although the latent free riding variable within this model configuration has no specific unit representation, because it has been standardized[48], it does have a scaling. The scaling of the latent variable is determined by the scaling of manifest variables. As a result, a relatively low score on the latent free riding variable indicates that an individual demonstrates a high level of free riding, while a relatively high score indicates a low level of free riding. In other words if one is not free riding there would be a relatively high score on the latent variable and a corresponding high value on the Likert scale responses for Q9a, Q9b, Q9g, Q9i and Q9k and a correspondingly low value on the Likert scale response for Q9c. The negative sign on the Q18 dummy variable indicates that if a respondent answered "Yes; I do nothing if I have a concern about how the cooperative is being operated" they would be moved lower on the free riding latent variable indicating a

[48] The latent free riding variable is standardized because a value of zero was assigned as the mean and a value of one was assigned as the variance in order for the model to be mathematically identified.

higher level of free riding. Therefore, the signs of the standardized factor loadings are consistent with the expected signs.

The standardized factor loadings indicate that there is no single dominant indicator for the latent free riding variable, but rather a variety of member actions that can contribute information towards describing member free riding. The good overall model fit indicates that the single latent construct, member free riding, does a good job of explaining the variation and co-variation of the manifest indicator variables. Thus, there is a tendency for these indicators to move together which implies that an individual who free rides in one activity also tends to free ride in other activities.

Therefore, the null hypothesis is rejected and there is no single dominant member free riding action and/or behavior found within UPI. There are strong indications that there are multiple member free riding actions and/or behaviors that coexist. This finding suggests that focusing on one indicator or proxy for member free riding may not fully capture all of the key attributes of free riding behavior. It also suggests that identifying and describing member free riding within collective action organizations may be more complex than first believed. These concepts will be expanded upon in Chapter 7.

6.2. Research Question Two

Can member free riding be influenced by the by-laws and policies of the collective action organization under analysis?

Hypothesis 2: Member free riding can be influenced by the by-laws and policies of the collective action organization under analysis.

H_0: The by-laws and policies of the collective action organization under analysis do not influence member free riding actions and/or behavior.

The objective of this research question is not to establish all the factors which influence free riding behavior, but rather to determine if the cooperative's by-laws and policies influence member free riding. Therefore, the latent variable structural model (SM) used to test the second hypothesis contains a set of control variables which were assembled from the collective action literature and research conducted on cooperative business organizations. This set of control variables should not be considered exhaustive, but rather a first attempt at identifying key factors which influence free riding behavior in patron owned collective action organizations.

The SM used to test the second hypothesis utilizes the latent free riding variable used to test the first hypothesis as an endogenous latent variable. A combination of manifest variables and latent variables were chosen as control variables to test for the

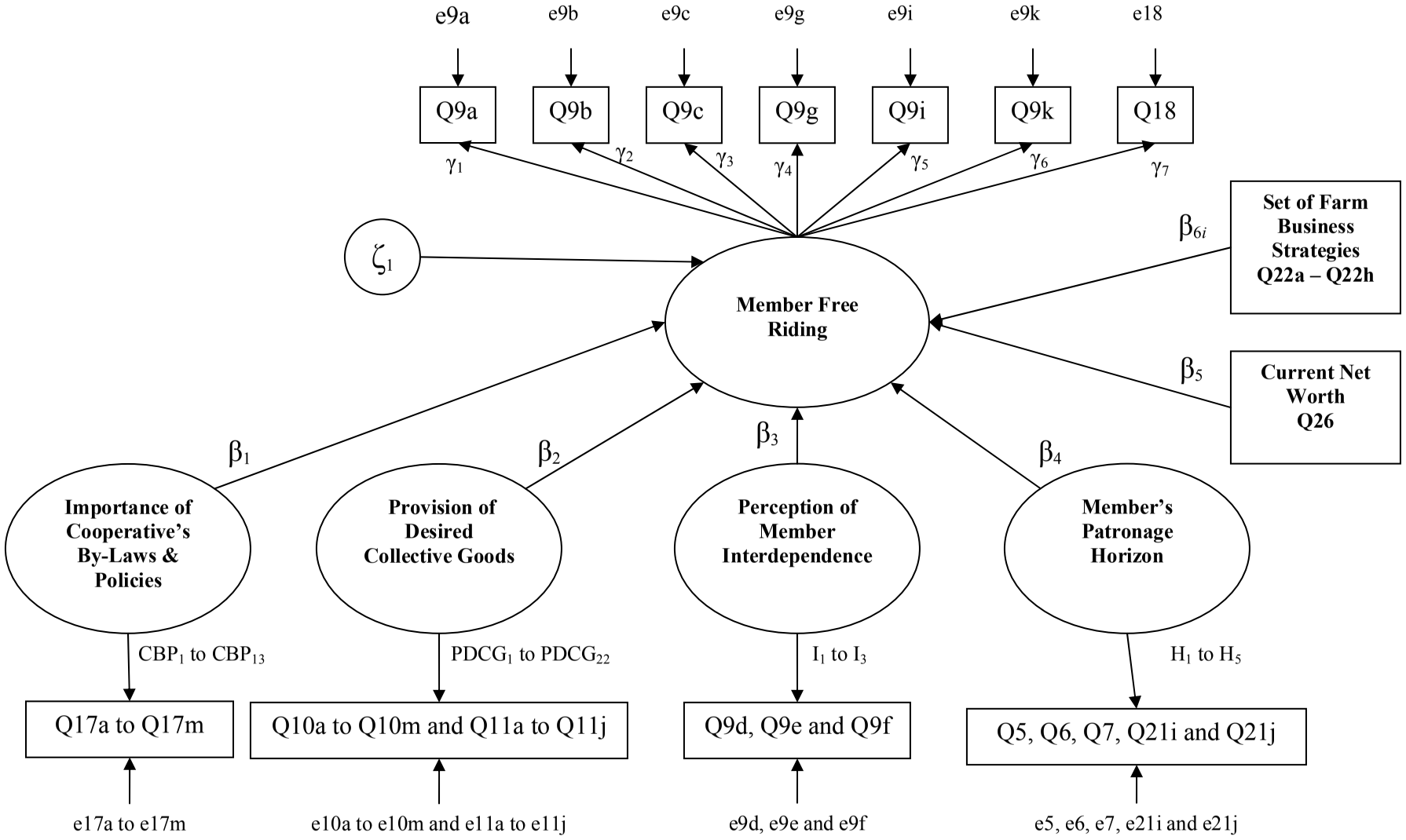
relative impact of the cooperative's by-laws and policies on member free riding. The general functional form of the model is:

$$FR = f(CBP) \text{ s.t. } PDCG, I, H, W, GS, FS$$

- *FR* = Free riding behavior by cooperative members.
- *CBP* = Importance of the cooperative's by-laws and policies in the member's decision to patronize the cooperative.
- *PDCG* = Provision of the desired collective goods.
- *I* = Perception of interdependence for supply of the collective goods.
- *H* = Member's patronage horizon.
- *W* = Member's current net worth.
- *GS* = Farm Gross Sales.
- *FS* = General farm business strategy.

The SM path diagram for this model is presented in Figure 4. Each of the exogenous latent variables will be discussed individually before an analysis of the full model is discussed.

Figure 4: Path Diagram of the Latent Variable Structural Model Used to Test Research Hypothesis 2 .



6.2.1. Importance of the Cooperative's By-Laws and Polices:

The importance of the cooperative's by-laws and policies in the decision to patronize the cooperative was modeled as a single latent variable. A single latent variable was chosen because the influence of the set of by-laws and policies on patronage is not directly observable and the cooperative presents the entire set of policies to the member. A member of UPI cannot choose which by-law and policy provisions they want to adhere to as a condition for patronage, with the exception of not requesting a refund of the preferred membership fee.

A CFA model was developed and tested to determine the relevance of this approach. All of the items contained within survey Question 17 were used as manifest indicator variables for the latent variable labeled *Importance of Cooperative By-Laws and Polices (CBP)* in Figure 4. See the member survey reproduced in Appendix A for the specific questions used to represent each of the manifest variables for the *CBP* latent variable. The correlation coefficient matrix for these manifest variables is provided in Appendix C. A path diagram of the CFA model for *CBP* is provided in Figure 5.

There were five modifications made to the CFA model in Figure 5 during the analysis process. First, correlations were added between the error terms for Q17f (maintain voting privileges), Q17g (elect district delegates) and Q17h (elect directors). All three of these items are measures of how important voting privileges are to the patronage decision. Therefore, it is reasonable to assume that these error terms share common measurement error. The second modification was to add a correlation between the error terms of Q17j (swine retain) and Q17k (other species retain). Because the majority of the cooperative's members are cattle producers, it is reasonable to assume

that there is shared measurement error in their responses to the importance of swine and other species retains. The final modification was to add a correlation between the error terms of Q17l (five year equity revolvement) and Q17m (equity cap). Both of these questions concern the importance of the cooperative's equity revolvement policy, so it would be reasonable to assume that there is shared measurement error between these variables.

Table 13 provides summary statistics for the survey questions used as manifest indicator variables of the *CBP* latent variable. Table 14 provides the unstandardized factor loadings, standardized factor loadings, estimated standard errors, critical ratios, *P* values and squared multiple correlations for the *CBP* Confirmatory Factor Analysis Model. While Table 15 lists the model fit statistics for the *CBP* model

Figure 5: Path Diagram of the Confirmatory Factor Analysis Model for *Importance of Cooperative By-Laws and Polices*.

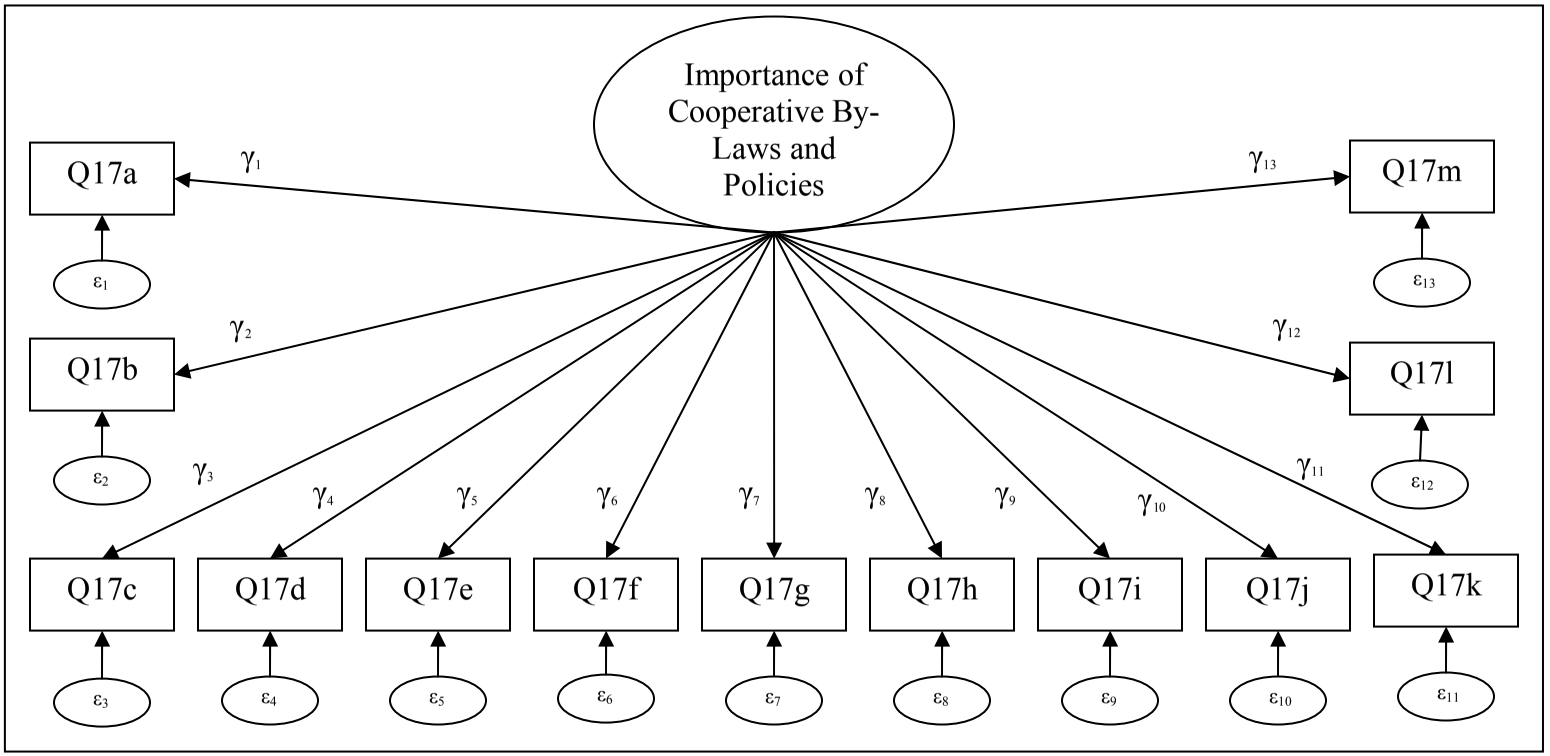


Table 13: Summary Statistics for Survey Questions Used as Manifest Indicator Variables for the *Importance of Cooperative By-Laws and Policy* Latent Variable.

Variable[1]	Not Applicable 0	Very Unimportant 1	2	3	4	Very Important 5	Missing	Mean	Variance
Q17a	51	154	66	162	66	33	43	2.26	1.97
Q17b	236	100	43	90	35	20	51	1.33	2.33
Q17c	129	85	38	110	107	47	59	2.24	2.98
Q17d	109	79	51	117	125	42	52	2.37	2.75
Q17e	68	69	57	133	141	57	50	2.73	2.43
Q17f	74	84	55	134	119	61	48	2.61	2.55
Q17g	71	84	53	120	126	73	48	2.69	2.65
Q17h	63	86	53	112	131	80	50	2.77	2.64
Q17i	102	69	66	170	81	39	48	2.33	2.40
Q17j	279	55	36	73	48	15	69	1.21	2.49
Q17k	345	46	23	51	24	10	76	0.78	1.86
Q17l	90	87	46	173	78	34	67	2.32	2.34
Q17m	114	83	40	144	89	42	63	2.27	2.70

1 The items in Question 17 were ordered alphabetically for top to bottom.

Table 14: Unstandardized Factor Loadings, Standardized Factor Loadings, Estimated Standard Errors, Critical Ratios, *P* Values and Squared Multiple Correlations for the *Importance of Cooperative By-Laws and Policy* Confirmatory Factor Analysis Model.

Manifest Variable	Untandardized Factor Loadings	Standardized Factor Loading	Estimated Standard Error	*z* Critical Ratio[1]	*P* Value	Squared Multiple Correlation
Q17a	0.771	0.550	0.059	13.096	***	0.303
Q17b	0.814	0.534	0.065	12.557	***	0.285
Q17c	1.261	0.732	0.068	18.666	***	0.536
Q17d	1.248	0.752	0.064	19.496	***	0.566
Q17e	1.297	0.834	0.057	22.737	***	0.695
Q17f	1.270	0.796	0.060	21.247	***	0.633
Q17g	1.230	0.755	0.063	19.656	***	0.570
Q17h	1.184	0.728	0.063	18.655	***	0.531
Q17i	0.809	0.523	0.066	12.279	***	0.273
Q17j	0.389	0.247	0.073	5.399	***	0.061
Q17k	0.420	0.308	0.063	6.704	***	0.095
Q17l	1.039	0.680	0.062	16.784	***	0.462
Q17m	1.074	0.653	0.067	15.938	***	0.426

*** Indicates a *P* value of less than 0.001 (two-tailed)

1 This model has 62 degrees of freedom

Table 15: Selected Model Fit Indices for the *Importance of Cooperative By-Laws and Policy* Confirmatory Factor Analysis Model.

Fit Index	Estimated Model Value	Recommended Value
χ^2_m	371.65[1]	Value heavily influenced by sample size. No general recommendation
Root-Mean-Square Error of Approximation (RMSEA)	0.095[2]	0.05 or less = close fit 0.05 ≤ value ≤ 0.08 = good fit Value ≥ 0.10 poor fit
Akaike Information Criterion (AIC)	459.65	Used to rank nested models with same structure. Smaller values indicate better fit.
Normed Fit Index (NFI)	0.924	0.90 or greater = good fit
Comparative Fit Index (CFI)	0.935	0.90 or greater = good fit
Tucker-Lewis Index (TLI)	0.902	0.95 or greater = superior fit

1 This model has 60 degrees of freedom. The *p* value was less than 0.001 so H_o is not rejected.

2 90 % confidence interval = 0.086 to 0.105

6.2.1.1. Interpretation of Results: All estimated factor loadings associated with the manifest indicator variables, listed in Table 14, were highly statistically significant. The model fit statistics, listed in Table 15, indicate good overall model fit. The highly significant individual factor loadings indicate that the latent variable does have a statistically significant effect on each individual manifest variable. The good overall fit statistics indicate that there is a good match between the variances and covariance of the manifest variables implied by the single latent variable and the variances and covariances found in the survey data.

The lack of a single dominant policy provision, or sub-set of provisions, indicates that each of the cooperative's by-law and policy provisions plays a role in a member's patronage decision. However, not all by-law and policy provisions are equally important across individual members. For example, the relatively large standardized factor loadings for Q17f (maintain voting privileges), Q17g (elect district delegates) and Q17h (elect directors), with values of 0.796, 0.755 and 0.728 respectively, indicate that maintaining control rights in the cooperative has a significant impact on the patronage decision and is consistent across a wide range of members. The relatively large standardized factor loadings for Q17c (discounted tariffs), Q17d (access to consulting) and Q17e (future patronage), with values of 0.732, 0.752 and 0.834 respectively, indicates that access to preferred member benefits and future cooperative earnings are also important to a wide range of members.

The questions concerning member financial resource contributions also had relatively strong standardized factor loadings, although lower than the indicator variables for control rights and rights to member benefits. The standardized factor loadings of

0.550, 0.523, 0.680 and 0.653 for Q17a (preferred membership fee), Q17i (cattle retain), Q17l (five year equity revolvement) and Q17m (equity cap), respectively, indicate that the patronage decision is also influenced by the required financial resource contributions. The positive coefficient sign on these factor loadings does not mean that each provision has a positive economic influence on the member, but rather that the provision is considered important. For example, the positive standardized factor loading of 0.523 on Q17i, $0.75 per unit cattle retain, indicates that this is considered an important element in the patronage decision, not that it is considered a benefit to the member.

The relatively small standardized factor loadings for Q17j (swine retain) and Q17k (other species retain), with values of 0.247 and 0.308 respectively, indicate a lower level of general importance. It would be reasonable to assume that the $0.25 per head capital retain on hogs may not play an important role in the decision of a cattle producer to patronize the cooperative, but can still be important to the hog producer.

Because of the phrasing used for this question, it was not possible to determine if the estimated factor loadings for the required member financial contributions are viewed as positive or negative. They could be viewed as positive if the member believes the respective capital retains were reasonable and the equity redemption plan is relatively short, when compared to other cooperatives. Or, they could be viewed negatively if the member considered them unreasonable or excessive.

6.2.2. Provision of Desired Collective Goods:

The general joint products model presented in Chapter 3 introduced the proposition that collective activities could simultaneously produce both public good outputs and private good outputs. Sandler (1992) discussed research studies that tested

for and found the presence of joint products in alternative collective action activities. Sandler (2004) provided examples of global collective action organizations that were attempting to capture economies of scale by providing multiple collective benefits to participating members. Peterson and Anderson (1996) found that agricultural cooperatives in the northeastern portion of the U.S. had adopted business strategies that create a variety of differential member level benefits. There is also anecdotal evidence that many agricultural cooperatives, like UPI, create a variety of collective benefits for their members. All of these references suggest that it is not unusual for collective action groups to provide multiple benefits to participating members.

Although research findings indicate that joint products can increase total contribution levels for public goods and hold the potential to more closely align the relationship between the costs of supporting an organization and the benefits received by participants, there is no general proof that the presence of joint products can eliminate suboptimal provision levels.

The basic proposition is that by providing a variety of closely related collective benefits a group could potentially gain from economies of scale and scope, increasing the net member benefit though reduced costs and providing multiple benefits. The multiple collective goods may also reach a broader range of members and potentially reduce the level of free riding.

However, an alternative outcome is also possible. If the organization's leaders are unable to determine the appropriate bundle of desired collective benefits, some of the group's resources may be used to provide collective goods that are not highly valued by current or prospective members. The supply of these additional collective goods may

increases the total costs for operating the organization, potentially increasing the costs to the members and/or reducing the supply of the more valued collective goods. This increases the potential that members will become dissatisfied with the organization and increase their free riding activities or leave the organization.

The objective of this section is to propose one method to control for the impact that providing multiple collective goods may have on free riding behavior, and thus determine the relative importance of the cooperative's by-laws and policies. In order to accomplish this, a range of potential collective goods created by UPI were identified and reviewed by UPI's senior management. Two questions were asked for each of the identified collective goods. The first: "How important is this UPI objective to the success of your farming operation?" The second: "How effectively has UPI fulfilled this objective?" Survey questions 10 and 11, reproduced in Appendix A, provide a list of the alternative collective goods identified. The responses to each of these questions were scored on a five point Likert scale.

An Exploratory Factor Analysis (EFA) was performed to determine if there were common relationships between the responses to these questions. Based upon the scree plot and alternative factor extractions, five potential factors were identified. Each of the survey items in Questions 10 and 11 were assigned to one of the five factors based upon conceptual association and the estimated EFA factor loadings. This assignment became the basis for five CFA models. Appendix B provides the scree plot, the communalities for each variable, the rotated component matrix for the Varimax rotation method and the structure and component correlation matrices for the Promax rotated factor solution.

Each of the five CFA models was analyzed independently. The alternative factors were labeled: 1) *Importance of Seller Benefits*, 2) *Provision of Seller Benefits*, 3) *Provision of Important Buyer Benefits*, 4) *Provision of Important Borrower Benefits* and 5) *Provision of Important Volume Benefits*. The results from each CFA analysis are provided in Appendix C and contain a table of summary statistics for each survey question used as a manifest indicator variable, the estimated correlation coefficients across indicator variables, the CFA factor loadings and significance statistics for each manifest variable and the overall model fit statistics for each factor.

All of the individual manifest indicator variables for each of the five CFA models were highly statistically significant with estimate *p* values of less than 0.001. Table 16 provides a summary of selected overall fit statistics for each of the five CFA models.

Table 16: Selected Fit Statistics of the Identified Confirmatory Factor Analysis Models for Provision of Desired Collective Benefits

Fit Statistic	Importance of Seller Benefits	Provision of Seller Benefits	Provision of Important Buyer Benefits	Provision of Important Borrower Benefits	Provision of Important Volume Benefits
χ^2_m	281.02 [1]	204.31 [2]	882.85 [3]	803.80 [4]	364.64 [5]
RMSEA	0.114	0.095	0.215	0.212	0.562
AIC	345.02	268.31	948.85	873.80	388.64
NFI	0.898	0.927	0.827	0.868	0.722
CFI	0.908	0.938	0.831	0.871	0.722
TLI	0.847	0.896	0.710	0.764	-0.392

1 This model has 33 degrees of freedom. The *p* value was less than 0.001 so H_o is not rejected.
2 This model has 33 degrees of freedom. The *p* value was less than 0.001 so H_o is not rejected.
3 This model has 32 degrees of freedom. The *p* value was less than 0.001 so H_o is not rejected.
4 This model has 30 degrees of freedom. The *p* value was less than 0.001 so H_o is not rejected.
5 This model has 2 degrees of freedom. The *p* value was less than 0.001 so H_o is not rejected.

The *Provision of Seller Benefits* (Prov. Sell) factor had good overall model fit, while the *Importance of Seller Benefits* (Imp. Sell) factor had moderate overall model fit.

This indicates that the implied variances and covariances of the manifest variables from a single factor model does a good to moderate job of explaining the total manifest variable variance and covariances present in the survey data. However, the *Provision of Important Buyer Benefits* (Buyer Ben) and *Provision of Important Borrower Benefits* (Borr Ben) have relatively poor overall model fit. This indicates that although each manifest indicator variable for these latent constructs are influenced by the respective latent variable, the latent variable does not have the ability to explain a substantial portion of the total variance and covariance of the manifest variables found in the survey data. One possible explanation is that a minority of UPI members purchase feeder livestock from the cooperative and/or borrow funds from PPC, while all members sell production through the cooperative. Therefore, it is likely there is a core sub-group of members who place a high value on purchasing livestock and/or borrowing funds from the cooperative, while a larger group of members have mixed requests for these benefits.

The *Provision of Important Volume Benefits* (Vol Ben) had generally poor overall model fit. This may be a result of the manifest indicator variables not meeting the multivariate normality assumption used to estimate the model fit statistics. Two of the four manifest variables, Q10l1 and Q10m1, had bi-modal distributions. This indicates that the survey respondents had either a high desire for benefits from volume purchases or sales, or they did not.

6.2.3. Perception of Member Interdependence:

Collective action theorists have argued that the shape of the collective goods production function can influence an individual's motivation to participate in group action. It is argued that if an individual perceives that their marginal contribution can

significantly impact total group output, an incentive is created which can stimulate participation. Although the specific forms of the production functions for the collective goods produced by UPI are not known, a latent variable for the *Perception of Member Interdependence* (Interdep) was included as a control variable. There were three survey questions used as manifest indicator variables; Q9d (my business enhances group value), Q9e (more members increase value) and Q9f (more members decrease value). Because there were only three manifest variables for this latent variable, it is a just identified model and there is only one unique set of factor loadings to fit the model. Tables summarizing the survey question responses, the estimated correlation coefficients between manifest variables, individual factor loadings and coefficient statistics and overall model fit statistics for this model are provided in Appendix C.

6.2.4. Member's Patronage Horizon:

The final latent control variable measures the member's patronage horizon. There were five manifest indicator variables used for this latent variable; Q5 (current age), Q6 (years farming), Q7 (years UPI member), Q22i (transition farm to next generation) and Q22j (transition out of farming). All of these indicator variables were highly statistically significant, and the model had good overall model fit statistics. The summary statistics for these manifest variables and CFA model are presented in Appendix C.

6.2.5. Other Manifest Exogenous Variables:

There were 10 manifest variables that were used as direct exogenous control variables; they were Q22a-Q22h, Q25 and Q26. These are dummy variables used to identify alternative farm business strategies. These strategies include; maintain current farm size and enterprise mix (Q22a), increase acreage of existing crop enterprises

(Q22b), increase head of existing livestock enterprises (Q22c), adding value to current commodities produced (Q22d), adding a new farm enterprise (Q22e), increase efficiencies or reduced costs (Q22f), reduce acreage of existing crop enterprises (Q22g) and reduce head within existing livestock enterprises (Q22h). The final two manifest variables were categorical variables for gross farm sales (Q25) and current net worth (Q26). Summary statistics for these variables can also be found in Appendix C.

6.2.6. Testing Alternative Control Variables:

The first SM tested for the direct effects of the exogenous *CBP*, *Imp. Sell, Prov. Sell, Buyer Ben., Borr. Ben. and Vol. Ben* latent variables on the endogenous *Member Free Riding* latent variable. Table 17 lists the unstandardized factor loadings, standardized factor loadings, standard errors, critical ratios and *P* values for the exogenous latent variables on the endogenous latent variable. A complete listing of factor loadings, coefficient statistics for all of this model's manifest and latent variables, as well as overall model fit statistics, can be found in Appendix D.

Table 17: Unstandardized Factor Loadings, Standardized Factor Loadings, Estimated Standard Errors, Critical Ratios, and *P* Values for the *Member Free Riding, Cooperative By-Laws and Policies* and Provision of Important Member Benefits Structural Model.

Endogenous Variable	Exogenous Variable	Un-Std. Loadings	Std. Loading	Standard Error	Critical Ratio[1]	*P* Value
Free Riding	CBP	0.300	0.467	0.043	6.937	***
Free Riding	Imp. Sell	-0.083	-0.129	0.047	-1.759	0.079
Free Riding	Prov. Sell	0.244	0.379	0.046	5.290	***
Free Riding	Buyer Ben.	0.062	0.096	0.040	1.555	0.120
Free Riding	Borr. Ben.	-0.068	-0.105	0.041	-1.658	0.097
Free Riding	Vol. Ben.	-0.054	-0.084	0.044	-1.232	0.218

*** Indicates a *P* value of less than 0.001 (two-tailed)
1 This model has 1926 degrees of freedom

Based upon this model, the *CBP* (cooperative by-laws and policies) and *Prov. Sell* (provision of seller based benefits) latent variables are the only exogenous variables with

statistically significant factor loadings less than the critical *p* value of 0.05. Therefore, these two variables were retained, while the remaining four variables were removed from the analysis.

A second SM was then constructed which tested for the direct effects of the latent variables *CBP*, *Prov. Sell, Perception of Member Interdependence* (Interdep.) and *Member's Patronage Horizon* (Horizon) as well as the manifest variables Q22a – Q22g, Q25 and Q26. Table 18 lists the unstandardized factor loadings, standardized factor loadings, standard errors, critical ratios and *P* values for the exogenous latent and manifest variables on the endogenous *Member Free Riding* latent variable. A complete listing of factor loadings, coefficient statistics for all of this model's manifest and latent variables, as well as overall model fit statistics, can be found in Appendix D.

Table 18: Unstandardized Factor Loadings, Standardized Factor Loadings, Estimated Standard Errors, Critical Ratios, and *P* Values for the *Member Free Riding, Cooperative By-Laws and Policies, Provision of Seller Benefits, Perception of Member Interdependence, Member's Patronage Horizon* latent variable and direct manifest variable Structural Model.

Endogenous Variable	Exogenous Variable	Un-Std. Loadings	Std. Loading	Standard Error	Critical Ratio[1]	*P* Value
Free Riding	CBP	0.129	0.259	0.029	4.502	***
Free Riding	Prov. Sell	0.107	0.215	0.028	3.805	***
Free Riding	Interdep.	0.231	0.463	0.033	7.069	***
Free Riding	Horizon	0.044	0.089	0.024	1.838	0.066
Free Riding	Q22a	0.062	0.062	0.042	1.451	0.147
Free Riding	Q22b	0.034	0.028	0.052	0.666	0.505
Free Riding	Q22c	0.047	0.045	0.044	1.064	0.288
Free Riding	Q22d	-0.067	-0.058	0.049	-1.373	0.170
Free Riding	Q22e	0.072	0.040	0.076	0.946	0.344
Free Riding	Q22f	0.110	0.108	0.044	2.519	0.012
Free Riding	Q22g	-0.096	-0.029	0.144	-0.672	0.502
Free Riding	Q22h	0.035	0.016	0.091	0.384	0.701
Free Riding	Q25	-0.005	-0.016	0.014	-0.367	0.714
Free Riding	Q25	0.028	0.056	0.022	1.257	0.209

*** Indicates a *P* value of less than 0.001 (two-tailed)
1 This model has 1063 degrees of freedom

Based upon the analysis of this second model, all of the exogenous latent variables were retained, along with Q22f (increase efficiency) exogenous manifest variable. The remaining exogenous manifest variables (Q22a – Q22e, Q22g, Q22h, Q25 and Q26) were dropped from further consideration due to poor statistical significance. The revised model was then re-analyzed.

6.2.7. SM Used to Test the Second Study Hypothesis:

Table 19 lists the unstandardized and standardized factor loadings, estimated standard errors, critical ratios and *P* values for the model used to test the second study hypothesis. Table 20 lists the estimated correlations, standard errors, critical ratios and *P* values for the modeled correlations between relevant latent variables, while Table 21 lists the selected overall model fit indices.

All of the individual estimated factor loadings, as well as estimated covariances, were statistically significant at the critical value of 0.05 or less. The model fit indices indicate moderate to good overall model fit.

Based upon the standardized factor loadings, the *Perception of Member Interdependence* latent variable had the greatest influence on the *Member Free Riding* endogenous latent variable, with a standardized factor loading of 0.458. The *Cooperative By-Laws and Policies* and *Provision of Seller Benefits* latent variables both had similar effects on the *Member Free Riding* variable, with standardized factor loadings of 0.271 and 0.212 respectively. While the *Member's Patronage Horizon* latent variable and the manifest variable Q22f, increase farm efficiencies, both had relatively limited influence with standardized factor loadings of 0.106 and 0.096 respectively. The estimated squared multiple correlation, or R^2, for the latent free riding variable was 0.560.

Table 19: Unstandardized Factor Loadings, Standardized Factor Loadings, Estimated Standard Errors, Critical Ratios, and *P* Values Structural Model used to test Research Hypothesis 2.

Endogenous Variable	Exogenous Variable	Un-Std. Loadings	Std. Loading	Standard Error	Critical Ratio[1]	*P* Value
Free Riding	CBP	0.135	0.271	0.029	4.653	***
Free Riding	Prov. Sell	0.106	0.212	0.028	3.733	***
Free Riding	Interdep.	0.229	0.458	0.033	6.994	***
Free Riding	Horizon	0.053	0.106	0.024	2.159	0.031
Free Riding	Q22f	0.098	0.096	0.044	2.230	0.026
Q9a	Free Riding	1.156	0.688	0.110	10.479	***
Q9b	Free Riding	0.711	0.440	0.093	7.659	***
Q9c	Free Riding	-0.412	-0.195	0.106	-3.895	***
Q9g	Free Riding	1.00	0.567	N.A.	N.A.	N.A.
Q9i	Free Riding	1.201	0.553	0.129	9.283	***
Q9k	Free Riding	1.201	0.492	0.129	9.283	***
Q18	Free Riding	-0.371	-0.420	0.050	-7.428	***
Q17a	CBP	0.759	0.542	0.059	12.895	***
Q17b	CBP	0.802	0.526	0.065	12.375	***
Q17c	CBP	1.255	0.729	0.067	18.616	***
Q17d	CBP	1.244	0.750	0.064	19.486	***
Q17e	CBP	1.294	0.833	0.057	22.791	***
Q17f	CBP	1.284	0.805	0.059	21.695	***
Q17g	CBP	1.245	0.765	0.062	20.089	***
Q17h	CBP	1.198	0.738	0.063	19.059	***
Q17i	CBP	0.810	0.524	0.066	12.341	***
Q17j	CBP	0.375	0.238	0.073	5.161	***
Q17k	CBP	0.415	0.305	0.062	6.645	***
Q17l	CBP	1.027	0.673	0.062	16.593	***
Q17m	CBP	1.068	0.650	0.067	15.904	***
Q9d	Interdep.	0.513	0.638	0.036	14.369	***
Q9e	Interdep.	0.595	0.775	0.034	17.620	***
Q9f	Interdep.	-0.485	-0.604	0.036	-13.547	***
Q10a2	Prov. Sell	1.016	0.715	0.057	17.930	***
Q10b2	Prov. Sell	1.048	0.722	0.058	18.092	***
Q10c2	Prov. Sell	1.112	0.785	0.055	20.358	***
Q10d2	Prov. Sell	1.074	0.763	0.055	19.474	***
Q10e2	Prov. Sell	0.946	0.559	0.072	13.085	***
Q10h2	Prov. Sell	0.945	0.647	0.060	15.657	***
Q10k2	Prov. Sell	0.897	0.528	0.075	12.023	***
Q11a2	Prov. Sell	0.829	0.658	0.052	15.903	***
Q11d2	Prov. Sell	0.814	0.620	0.055	14.870	***
Q11g2	Prov. Sell	0.883	0.604	0.063	14.098	***

Table 19 (cont.): Unstandardized Factor Loadings, Standardized Factor Loadings, Estimated Standard Errors, Critical Ratios, and *P* Values Structural Model used to test Research Hypothesis 2.

Endogenous Variable	Exogenous Variable	Un-Std. Loadings	Std. Loading	Standard Error	Critical Ratio[1]	*P* Value
Q5	Horizon	10.723	0.844	0.518	20.711	***
Q6	Horizon	12.282	0.886	0.564	21.773	***
Q7	Horizon	6.329	0.450	0.661	9.577	***
Q22i	Horizon	0.138	0.342	0.018	7.631	***
Q22j	Horizon	0.038	0.149	0.012	3.243	0.001

*** Indicates a *P* value of less than 0.001 (two-tailed)
1 This model has 687 degrees of freedom

Table 20: Estimated Correlations for the Structural Model used to test Research Hypothesis 2.

Variables		Correlation Estimate	Standard Error	Critical Ratio [1]	*P* Value
Interdep.	Horizon	0.266	0.048	5.514	***
Interdep.	CBP	0.317	0.048	6.576	***
Interdep.	Prov. Sell	0.280	0.050	5.633	***
CBP	Prov. Sell	0.454	0.041	11.164	***
e9a	e9b	0.147	0.026	5.666	***
e9i	e9k	0.338	0.047	7.190	***
e17f	e17g	0.782	0.069	11.364	***
e17g	e17h	1.032	0.080	12.887	***
e10a2	e10b2	0.627	0.064	9.863	***
e10c2	e10d2	0.538	0.057	9.416	***
e17f	e17h	0.800	0.070	11.370	***
e17j	e17k	1.069	0.102	10.490	***
e17l	e17m	0.648	0.077	8.418	***

*** Indicates a *P* value of less than 0.001 (two-tailed)
1 This model has 685 degrees of freedom

Table 21: Selected Model Fit Indices for the Structural Model used to test Research Hypothesis 2.

Fit Index	Estimated Model Value	Recommended Value
χ^2_m	1702.59[1]	Value heavily influenced by sample size. No general recommendation
Root-Mean-Square Error of Approximation (RMSEA)	0.051[2]	0.05 or less = close fit 0.05 ≤ value ≤ 0.08 = good fit Value ≥ 0.10 poor fit
Akaike Information Criterion (AIC)	1970.59	Used to rank nested models with same structure. Smaller values indicate better fit.
Normed Fit Index (NFI)	0.843	0.90 or greater = good fit
Comparative Fit Index (CFI)	0.899	0.90 or greater = good fit
Tucker-Lewis Index (TLI)	0.885	0.95 or greater = superior fit

1 This model has 687 degrees of freedom. The *p* value was less than 0.001 so H_o is not rejected.
2 90 % confidence interval = 0.048 to 0.054

The positive sign on the model's estimated factor loadings are consistent with the expected coefficient signs. Once again, a high value on the scaling of the *Member Free Riding* latent variable indicates a low level of free riding behavior. Therefore, as the scaling factor for the exogenous model variables increase there is a corresponding increase in the value of the endogenous *Member Free Riding* latent variable, indicating a reduction in the level of free riding behavior.

For example, assume there are two members of UPI. Individual "A" indicated that the alternative components of the cooperative's by-laws and policies were important to their patronage decision (i.e. placed relatively high values on Q17a – Q17m) while individual "B" indicated the by-laws and policies were unimportant to their patronage decision (i.e. placed relatively low values on Q17a – Q17m). Individual "A" would have a relatively larger value on the standardized scaling factor of the *CBP* latent variable than individual "B". This is due to the positive estimated factor loadings for the *CBP* manifest indicator variables. The positive standardized factor loading of 0.271 between the

exogenous *CBP* latent variable and the endogenous *Member Free Riding* latent variable indicates that individual "A" also had a larger standardized score than individual "B" on the scaling for the *Member Free Riding* latent variable. This indicates that individual "A" was less likely to free ride, based upon their responses to the questions used as indicator variables for the *Member Free Riding* latent variable (i.e. Q9a, Q9b, Q9c, Q9g, Q9i, Q9k and Q18).

6.2.8. Alternative SM Configuration Used to Test the Second Study Hypothesis:

An alternative SM configuration which did not include the *Provision of Seller Benefits* latent variable was also analyzed. This alternative configuration implies that the organization, in this case UPI, is supplying the correct mix of desired collective benefits so the variation in free riding activities is a result of the *CBP, Interdependence* and *Horizon* latent variables and the single manifest variable from increasing farm efficiency business strategy. The results for this alternative model are presented in Tables 22 through 24. Table 22 lists the unstandardized and standardized factor loadings, estimated standard errors, critical ratios and *P* values for the model used to test the alternative configuration. Table 23 lists the estimated correlations, standard errors, critical ratios and *P* values for the modeled correlations between relevant latent variables, while Table 23 lists the selected overall model fit indices.

This alternative model also had highly statistically significant individual factor loadings and good overall fit statistics. The standardized factor loading for the *CBP* latent variable on the *Member Free Riding* latent variable increased from 0.271 in the

first configuration to 0.362 in the alternative configuration. The standardized factor loadings for the *Interdependence* and *Horizon* latent variables also increased from 0.458

Table 22: Unstandardized Factor Loadings, Standardized Factor Loadings, Estimated Standard Errors, Critical Ratios and *P* Values for the *Member Free Riding, Cooperative By-Laws and Policies, Perception of Member Interdependence, Member's Patronage Horizon* latent variables and Increase Farm Efficiency direct manifest variable Structural Model.

Endogenous Variable	Exogenous Variable	Un-Std. Loadings	Std. Loading	Standard Error	Critical Ratio[1]	*P* Value
Free Riding	CBP	0.191	0.369	0.029	6.525	***
Free Riding	Interdependence	0.243	0.470	0.034	7.206	***
Free Riding	Horizon	0.058	0.113	0.026	2.249	0.025
Free Riding	Increase Eff.	0.095	0.090	0.047	2.043	0.041
Q9a	Free Riding	1.074	0.662	0.103	10.384	***
Q9b	Free Riding	0.654	0.419	0.088	7.404	***
Q9c	Free Riding	-0.383	-0.188	0.102	-3.741	***
Q9g	Free Riding	1.000	0.588	N.A.	N.A.	N.A.
Q9i	Free Riding	1.185	0.566	0.125	9.456	***
Q9k	Free Riding	1.091	0.511	0.124	8.772	***
Q18	Free Riding	-0.360	-0.421	0.048	-7.466	***
Q17a	CBP	0.761	0.543	0.059	12.922	***
Q17b	CBP	0.798	0.523	0.065	12.299	***
Q17c	CBP	1.254	0.728	0.067	18.574	***
Q17d	CBP	1.242	0.749	0.064	19.409	***
Q17e	CBP	1.297	0.835	0.057	22.851	***
Q17f	CBP	1.282	0.804	0.059	21.630	***
Q17g	CBP	1.243	0.764	0.062	20.008	***
Q17h	CBP	1.196	0.737	0.063	18.994	***
Q17i	CBP	0.808	0.523	0.066	12.304	***
Q17j	CBP	0.380	0.241	0.073	5.227	***
Q17k	CBP	0.416	0.305	0.063	6.650	***
Q17l	CBP	1.032	0.676	0.062	16.685	***
Q17m	CBP	1.071	0.652	0.067	15.944	***
Q9d	Interdep.	0.504	0.625	0.036	14.047	***
Q9e	Interdep.	0.602	0.785	0.034	17.792	***
Q9f	Interdep.	-0.492	-0.613	0.036	-13.743	***
Q5	Horizon	10.666	0.840	0.518	20.598	***
Q6	Horizon	12.346	0.891	0.564	21.900	***
Q7	Horizon	6.346	0.451	0.660	9.612	***
Q22i	Horizon	0.138	0.341	0.018	7.626	***
Q22j	Horizon	0.038	0.148	0.012	3.213	0.001

*** Indicates a *P* value of less than 0.001 (two-tailed)

1 This model has 365 degrees of freedom

Table 23: Estimated Correlations for the *Member Free Riding, Cooperative By-Laws and Policies, Perception of Member Interdependence, Member's Patronage Horizon* latent variables and Increase Farm Efficiency direct manifest variable Structural Model.

Variables		Correlation Estimate	Standard Error	Critical Ratio [1]	*P* Value
Interdep.	Horizon	0.266	0.048	5.498	***
Interdep.	CBP	0.308	0.048	6.385	***
e9a	e9b	0.164	0.027	6.181	***
e9i	e9k	0.318	0.047	6.730	***
e17f	e17g	0.787	0.069	11.363	***
e17g	e17h	1.037	0.081	12.880	***
e17f	e17h	0.805	0.071	11.365	***
e17j	e17k	1.067	0.102	10.479	***
e17l	e17m	0.641	0.077	8.351	***

*** Indicates a *P* value of less than 0.001 (two-tailed)
1 This model has 365 degrees of freedom

Table 24: Selected Model Fit Indices for the *Member Free Riding, Cooperative By-Laws and Policies, Perception of Member Interdependence, Member's Patronage Horizon* latent variables and Increase Farm Efficiency direct manifest variable Structural Model.

Fit Index	Estimated Model Value	Recommended Value
χ^2_m	1079.16[1]	Value heavily influenced by sample size. No general recommendation
Root-Mean-Square Error of Approximation (RMSEA)	0.058[2]	0.05 or less = close fit 0.05 ≤ value ≤ 0.08 = good fit Value ≥ 0.10 poor fit
Akaike Information Criterion (AIC)	1277.16	Used to rank nested models with same structure. Smaller values indicate better fit.
Normed Fit Index (NFI)	0.856	0.90 or greater = good fit
Comparative Fit Index (CFI)	0.899	0.90 or greater = good fit
Tucker-Lewis Index (TLI)	0.879	0.95 or greater = superior fit

1 This model has 365 degrees of freedom. The *p* value was less than 0.001 so H_o is not rejected.
2 90 % confidence interval = 0.054 to 0.062

and 0.106, respectively, to 0.470 and 0.113, respectively. While the standardized factor loading for the manifest variable for increased farm efficiency business strategy decreased slightly from 0.096 to 0.090. The estimated squared multiple correlation (R^2) for the *Member Free Riding* latent variable decreased from 0.560 to 0.513.

Based upon the consistently positive and highly statistically significant factor loadings for the *Importance of the Cooperative's By-Laws and Policies* latent variable estimated within the alternative model configurations, the null hypothesis that the by-laws and policies of the cooperative do not influence member free riding behavior is rejected. There is evidence that the cooperative's by-laws and policies do play a role in a member's decision to patronize the cooperative and participate in the collective action process. The implications of this finding will be discussed in Chapter 7.

Chapter 7

Implications of Research Findings and Suggestions for Future Research

Although the challenges facing collective action activities and group coordination have been recognized for hundreds of years, identifying the core causes, proposing methods to confront these challenges and determining the effectiveness of alternative solutions has proven to be a daunting task. Theoretical work in the collective action area has focused on the inability to exclude non-collaborators. Because it is difficult or impossible to exclude individuals from accessing the benefits of group action, individual's lack the direct incentive to voluntarily bear the appropriate share of the cost for supplying the collective goods. This activity has become known as free riding or the free rider problem.

There are two very general strategies that have been discussed to mitigate this type of free riding. The first is to alter the environment surrounding the collective action activity by attempting to construct physical or institutional exclusion mechanisms to restrict access to the collective benefits and use the collective benefits as the incentive to participate in group activities. The second is to create alternative incentives that reward collaboration and/or resource contributions, penalize non-collaboration or utilize a combination of both rewards and punishment. Some of the proposed incentives include social incentives, bundling private and public goods, coercion and expulsion from the group. Designing alternative bundles of property rights to allocate benefits, costs and control rights have also been proposed for impure public goods like common pool resources.

The organizational economics literature has also used the term free riding. However within this literature, it is the inability to accurately observe and measure an individual's effort and/or amount of human capital provided within a team production setting which is the key condition that enables free riding. The primary solution within this context is to assign a monitor or manager to oversee the team's production activities, give the monitor the right to expel team members and reward the monitor with the residual benefits from the production process. However, if the residual benefits are shared among a large group, like in a publicly held corporation, the incentives to monitor team members, such as the firm's management, may not provide strong incentives. Using residual benefits as incentives to monitor team members may also be problematic if the residual benefits have public good attributes and the benefits are difficult to exclude. Under these conditions, the residual benefits cannot be exclusively assigned to the monitor(s) and are available to non-monitors, thus diluting the influence of the residual benefits.

Research results from the game theory and game experiments have also identified methods to improve coordination within groups. These results indicate that repeated interaction by group participants, open communication within the group, reciprocity of member actions and sanctioning non-collaborative members are activities that can increase group coordination and total group benefit. However, if group members fail to repeatedly interact with other members or fail to participate in communication and sanctioning activities they could be viewed as free riding on the efforts of other members.

All of these alternative viewpoints of free riding share a common foundation; they create challenges for groups or organizations to coordinate collective activities.

However, the specific behaviors or actions that are problematic are different. These actions include under provision of financial resources, under provision of effort or human capital, lack of monitoring of organizational leaders, limited interaction with other group members, limited communication with other group members and lack of sanctioning activities.

7.1. Implications of Research Question 1

The first research question asked if multiple free riding actions and/or behaviors coexist within United Producers Inc. (UPI). The results from the Confirmatory Factor Analysis indicate that there was no single dominant indicator of free riding, but suggest that multiple actions and/or behaviors coexist. The combination of good overall model fit statistics and highly statistically significant factor loadings for the single factor model indicate that the survey questions used as indicators for alternative free riding actions and/or behaviors share a single common source.

This finding has implications for researchers, the leadership of UPI and potentially for the leadership of other patron owned firms and collective action organizations. This finding suggests that the exclusion based, measurement based and interaction based perspectives of free riding all make contributions to describing and understanding free riding, and that there is a tendency for individuals that free ride in one activity to also free ride in other activities. Once again, these are activities and/or behaviors that represent essential resources needed to provide collective benefits and enhance the effectiveness of the collective action organization. This finding also suggests that even though each of these perspectives contributes to our understanding of

free riding, none of them fully describe all of the potential free riding activities. Therefore, researchers and the leadership of collective action organizations may not be able to target a single activity as an indicator or measure of free riding.

In addition, this finding has implications for the design, implementation and testing of alternative methods to mitigate free riding. As stated earlier, there are two general categories of proposed solutions to free riding. The first is to attempt to change the external characteristics or conditions that allow free riding go occur; primarily the inability to exclude benefits and the inability to accurately determine the marginal contributions of individual group or team members. In most cases, there are narrow limits to what an organization or its leadership can do to fundamentally alter these conditions. The second is to attempt to alter the relative incentives individuals face when determining their participation in collective efforts and the level of resource contributions made towards the collective activities. In this respect, there are steps that the organization and its leadership can take to create incentives which reward collaborative activities and/or punish non-collaborative activities. However, the particular actions and/or behaviors to incent must be specified. The initial findings from this study indicate that multiple actions and/or behaviors may need to be considered.

For example, a proposed incentive which rewards one time member financial contributions may increase the short term capital resources available to the organization, but it may not influence the level of member monitoring activities or encourage future financial contributions. In contrast, incentives which reward consistent repeated interaction with the organization, like repeat business with a cooperative, may offer more opportunities to monitor management actions and increase long term member financial

contributions, if financial contributions can be linked to the level of interaction. Rewarding repeated interaction may also make it easier for members to convey their preferences for individual or bundled collective benefits. The organization's leadership may also want to place greater emphasis on encouraging member interaction to foster a better understanding of how common group value is created, detail the member resource contributions that are required to supply collective benefits and how a member's marginal contribution could impact the total value created.

However, the likely coexistence of multiple free riding actions and/or behaviors may also complicate the implementation of targeted or selective incentives. If incentives are designed to address a set of free riding actions, how will the organization determine which individuals will receive the incentives? How costly will it be to identify and track the actions of these members? Will the organization have primary responsibility for monitoring and sanctioning member actions or will members play a significant role in these activities. For cooperatives, like UPI, the patronage relationship offers one relatively convenient and low cost method to track the level of individual member participation. However, patronage levels may or may not be a good indicator for some activities, like communication with other members. Other collective action organizations, like general farm organizations or political lobbying groups, may need to evaluate alternative systems to identify individuals or sub-groups that are targeted for unique treatment.

The first study finding raises many additional issues for future research efforts. Although there are strong indications that multiple free riding actions and/or behaviors

coexist, this research question must be re-tested across a broad range of collective action organizations to validate the findings and provided a more generalizable conclusion.

One suggested revision is to design and test a more extensive variety of free riding indicator variables to better capture potential exclusion based, measurement based and interaction based free riding activities. Although the indicator variables used in this study were relatively generic and are suitable for a variety of collective action organizations, it is unlikely they constitute the optimum set of variables. Additional indicator variables should be constructed and tested across a range of collective action organizations to determine the reliability of the indicators and the consistency of the findings from this study.

Because the *Percentage of total livestock marketed through the cooperative* (Q21b/Q21c) variable was dropped from the analysis, due to missing data problems, no direct connection could be made between free riding with respect to financial contributions and other free riding activities. However, there is anecdotal evidence from discussions with cooperative leaders that suggests there is a connection between these free riding activities. Therefore, one specific indicator that deserves attention and revision is an indicator for the portion of a member's total potential patronage that was conducted with the cooperative or collective action organization. This type of free riding indicator variable is especially relevant for patron owned collective action organizations. This variable captures two types of member resource contributions; A) the amount of available business volume that can be used by the cooperative to capture economies of scale and/or scope to exert competitive market pressure and B) the equity capital available for the cooperative to finance business operations and growth.

It may be possible to restate the survey questions used to collect the information for this variable and increase the response rate so this variable can be used in future studies[49]. Alternative indicator variables that could be considered for alternative cooperative business structures include; A) percentage of total net worth invested in the cooperative business, B) percentage of total farm gross income received from the cooperative, C) percentage of total farm purchases made from the cooperative and D) participation in the cooperative's annual meeting and/or other sponsored events. Preparing detailed case studies of the organizations chosen for analysis would significantly enhance the researcher's ability to determine which indicator variables are common across organizations and which indicators are unique to one organization, or a sub-group of organizations.

Once a reliable set of indicator variables have be identified, researchers can begin to test whether these variables are alternative measures of one common free riding construct or if there are actually separate constructs that are closely correlated. In other words, is there one free riding latent variable with a range of indicators that represent the exclusion, measurement and interaction based perspectives or are there three individual latent variables representing each of the three perspectives that are correlated? The answer to this question could also have significant impacts on the strategies that are developed to mitigate free riding activities. If there are multiple constructs that are closely related, effort could be focused on creating incentives to target the specific category of free riding that was most problematic. The estimated correlation coefficients between the constructs could then help determine the degree of spillover effects the

[49] One alternative would be to directly ask the survey respondent what percent of their total business volume was conducted with the cooperative, rather than asking for the physical quantities and calculating the percentage during data analysis.

incentives could have on other categories of free riding activity. However, if it is determined there is one common free riding construct, which was assumed in this study, incentives would need to address a broader set of free riding actions and possibly require that incentives be bundled together.

7.2. Implications for Research Question 2

The second research question asked if member free riding can be influenced by the by-laws and policies of UPI. Based upon the results from the Structural Model, there is evidence that the organization's by-laws and polices influence member free riding. The good overall model fit statistics indicate that there was a close match between the model implied variance/covariance matrix and the variance/covariance matrix contained in the data set. The standardized factor loading between the *Member Free Riding* latent variable and the *CPB* latent variable in the primary model was 0.268 and highly statistically significant. The estimated factor loading for the *CPB* latent variable remained statistically significant as alternative control variables were tested, indicating that the findings are robust to changes in control variables.

Although the standardized *CBP* factor estimate within the final model was not as large as the standardized estimate of 0.460 for the *Interdependence* latent variable, it was larger than the other control variables for *Provision of Seller Benefits* (0.212), *Membership Horizon* (0.106) and the manifest dummy variable for increasing farm efficiency as a business strategy (0.096). The implication is that the bundle of property rights created by the cooperative's by-laws and policies does influence member free riding actions. This is consistent with the findings from research case studies in the

common pool resource area and reinforces the proposition that collective action organizations can create incentives which influence member participation and reduce member free riding, resulting in enhanced provision of collective benefits.

This finding also suggests that the cooperative's members do pay attention to the cooperative's policies and indicates that cooperative leaders, as well as decision makers in other patron owned firms and collective action organizations, may be able to utilize the policy tools under their direct control to assign property rights which create incentives to influence member participation. This also suggests that these leaders should carefully evaluate the type of incentives and economic signals the organization's by-laws and policies are sending to their members. For example, the right to participate in the organization's governance was viewed as an important consideration in the patronage decision. UPI currently requires a minimum patronage level of 20 head per year and the payment of a $20 per year preferred membership fee to access control rights. Although these threshold levels are relatively low, they do send a signal to livestock producers that control rights are a reward for participation in the organization and providing the inputs needed by UPI to create collective benefits.

The current SM design indicates that the set of cooperative by-law and policy provisions have an influence on a given set of free riding activities. However, one cannot determine if specific policies have more or less influence on specific free riding actions. For example, give the current model design one cannot determined the direct impact that a change in Q17d (*Access to management and consulting services as a preferred member*) may have on Q9a (*I have consistently patronized UPI over the past 5 years*).

This could be extremely valuable information for cooperative leaders and help them design policies which could target specific free riding activities that are considered the most problematic. For example, would an increase in the preferred membership fee increase or decrease the incentive for members to convey their preferences for the bundle of collective benefits that are provided? Would this increased fee increase or decrease the incentive to maintain consistent year-to-year patronage levels?

Additional research work will need to be done to determine how responsive alternative free riding actions are to changes in specific by-law and policy provision. One approach to accomplish this would be to identify collective action organizations that are adjusting their policy provisions and survey members before and after the policy adjustments to measure changes in member free riding activities.

Monitoring changes from altered policy provisions would also substantially strengthen the SM's assumption of a causal relationship from the by-law and policy provisions to member free riding. This assumption was justified on the basis of the logic derived relationship proposed by Olson and reinforced by the research findings within the common pool resource area. It is also reasonable to assume that the causal flow would be from the by-laws and policies to member free riding rather than the causation being reversed. However, proving true causation of this relationship is difficult to accomplish with cross-sectional data. Conducting an event study, such as the one discussed above, could provide information on the conditions before and after a change in policy provisions and help validate the assumed causal flow, as well as help trace linkages between changes in specific policy provisions and alternative free riding activities.

Additional work is also needed to refine the indicators for the *CBP* latent variable. Efforts should focus on altering the structure and type of survey questions used as measurement variables. For example, it was not possible to determine if the cooperative equity investment variables (Q17l and Q17m) are viewed as positive incentives or negative incentives with the current structure of the survey question. Are they considered positive because of the relatively short equity revolvement period and limit on an individual's total required equity contribution? Or, are they viewed negatively and considered excessive?

Work must also be done to identify and accurately model a broader range of alternative control variables. The variables used in this study were a first attempt at identifying and describing alternative determinants of free riding behavior and should not be considered exhaustive. Specific attention should be given to the *Interdependence* latent variable, which had the highest standardized factor loading. This study used three manifest indicator variables for the *Interdependence* variable and asked if members viewed the organization as an inclusive or exclusive group and if they believed their patronage would substantially increase the value created for all members. Identifying additional significant indicators would strengthen the description of this variable and potentially add to our understanding of why individuals participate in collective action activities.

Many collective action organizations provide their members with a variety of collective benefits, but the impact of providing a range of collective benefits on member free riding is not clear. This study did find a relationship between how effectively the member believed the cooperative provided seller based benefits, like more reliable local

market information, and free riding behavior. The positive standardized factor loading between the *Provision of Seller Benefits* latent variable and the *Member Free Riding* latent variable (0.212) indicates that members who felt the cooperative was not doing an effective job of providing this set of member level benefits had higher levels of free riding actions.

However, the other latent variables describing the importance of seller benefits, provision of important buyer benefits, provision of important borrower benefits and the provision of important volume benefits did not have statistically significant factor loadings. This may be due to the fact that a minority of UPI members borrow funds from PPC, purchase feeder livestock through UPI and/or consider volume purchases and sales important member benefits. One potential explanation is that these alternative benefits may be important to specific sub-groups of members but not have a significant impact on overall member free riding activity. For example, the provision of important borrower benefits may act as a selective incentive and influence free riding behavior for the UPI members who also borrow funds from PPC, but have little influence on the free riding behavior of members who obtain financing from other entities. This is a hypothesis that could be tested in the future. Further theoretical and empirical work needs to be done to explore the influence that providing multiple collective benefits may have on member free riding.

Olson's definition of selective incentives indicated that incentives could be created that would target specific groups or sub-groups of individuals. The study's second hypothesis tested whether the cooperative's by-law and policy provisions created incentives which impacted member free riding, but did not formally test whether these

provisions influence various member sub-groups differently. However, a multi-group SM was created to explore the potential for designing and testing for differences in free riding between identified member sub-groups. Although the analysis is preliminary, the initial findings indicate that there are differences in levels of free riding between sub-groups and potentially differences in the relative impact the by-laws and policies have on free riding behavior. This is a research area that has the potential to make a significant contribution towards identifying, measuring and mitigating free riding within a heterogeneous membership base and should be aggressively pursued.

The final recommendation is to introduce an additional variable, or possibly a set of variables, which incorporates the member's social motivation. One key concept, which has been an ongoing debate between economists and sociologists, is the assumed social motivation of the individuals in the group or organization. McClintock (1972) classified individuals into four general classes of social motivation; they are 1) *individualism*, which is the motivation to maximize one's own benefits, 2) *competition*, which is the motivation to maximize the difference between one's own benefits and the benefits of others, 3) *cooperation*, which is the motivation to maximize joint benefits and 4) *altruism*, which is the motivation to maximize others benefits. This study assumed cooperative members attempted to maximize their own benefits, or the individualism classification. A single latent variable or set of variables for social motivation could be added to test the validity of this assumption and determine the influence social motivation has on alternative forms of free riding.

7.3. Conclusion

This study contributes to the existing literature on collective action by combining primary survey data with latent variable analysis techniques to identify the co-existence of multiple free riding actions and/or behaviors within the participating collective organization. The study has also shown that the member property rights defined by the organization's by-laws and policies have an impact on a set of member free riding activities. And finally, the study has laid a foundation for additional refinements and extensions to the study of free riding behavior and the ability to evaluate the effectiveness of alternative strategies for mitigating free riding activities.

APPENDIX A

United Producer, Inc. Membership Survey

United Producers, Inc. (UPI) Member Survey

This survey is concerned with how United Producers, Inc. (UPI) currently creates value for you and your farming/ranching operation. Our objective is to understand what types of services you desire, the relative emphasis you place on these services, and how well the cooperative is currently providing these services. The survey is a joint project between UPI and the University of Missouri's Graduate Institute of Cooperative Leadership.

The survey will take approximately 25 minutes to complete. All information that you provide is confidential, and will be aggregated with other survey respondents. Your participation is voluntary, and by completing and submitting this survey you are providing consent to include your information into the aggregate survey results. We hope you have the time to complete the survey and help UPI better serve your needs.

If you have questions or comments regarding this survey please call:

Michael L. Cook 573-882-0140

1) Are you currently a *Preferred Member* of United Producers, Inc. (UPI)?

Yes ☐ No ☐

2) In 2005, did you sell livestock through one of the UPI auction sites or branch locations? Yes ☐ No ☐ → **If *NO* go to question 5.**

3) Which UPI location do you utilize the most? (please check only one)

Ohio

Bucyrus	☐
Caldwell	☐
Creston	☐
Eaton	☐
Fort Loramie	☐
Gallipolis	☐
Hillsboro	☐
Mt. Vernon	☐
Stryker	☐
Wapakoneta	☐

Indiana

Frankfort	☐
Greencastle	☐
Little York	☐
Rushville	☐
Vincennes	☐
Wabash	☐

Missouri

Humansville	☐
Jackson	☐
Marshall	☐
Maryville	☐

Illinois

Apple River	☐
Cambridge	☐
Dietrich	☐
Golden	☐
Goreville	☐
Greenfield	☐
Milledgeville	☐
Raymond	☐
Salem	☐
Shelbyville	☐
Tampico	☐

Kentucky

Irvington	☐
Owenton	☐
Paris	☐

Michigan

Cass City	☐
Cassopolis	☐
Fowler	☐
Manchester	☐
St. Louis	☐

4) On average, how many miles do you travel to reach this location? _____ miles

5) What is your current age? _____ years

6) How long have you been farming or ranching (i.e. directly responsible for making management decisions and at risk for losses)? _____ years

7) How long have you been a member of UPI, or one of the previous cooperatives that became UPI? _____ years

8) Are you currently a *District Delegate* of United Producers, Inc. (UPI)?

Yes ☐ No ☐

9) How strongly do you **agree** or **disagree** with the following statements?

Statement:	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
I consider myself a very strong supporter of UPI.	1	2	3	4	5
I have consistently patronized UPI over the past 5 years.	1	2	3	4	5
If UPI does not offer the "best deal", I will do business elsewhere.	1	2	3	4	5
I believe the business I do with UPI significantly enhances UPI's ability to create value for all members.	1	2	3	4	5
I believe the value created by UPI's activities would substantially increase if more members were added.	1	2	3	4	5
I believe the value created by UPI's activities would substantially decrease if more members were added.	1	2	3	4	5
I regularly read the information UPI sends me.	1	2	3	4	5
I regularly visit UPI's web site to get current information about the cooperative or livestock markets.	1	2	3	4	5
I regularly discuss the activities of UPI with my neighbors.	1	2	3	4	5
My neighbor's support of UPI heavily influences my decision to use the cooperative.	1	2	3	4	5
I actively monitor the actions of UPI's management and employees.	1	2	3	4	5

10) Please indicate how important each of these possible objectives of UPI is to you and how effectively you feel UPI is fulfilling these objectives.

How important is this UPI objective to the success of your farming operation?	**Cooperative's Objective**	**How effectively has UPI fulfilled this objective?**
N.A. = Not Applicable ***Very Unimportant = 1*** ***Very Important =5***		
NA 1 2 3 4 5	Improve reliability and timeliness of cash (spot) market price information so I can make better **marketing** decisions.	NA 1 2 3 4 5
NA 1 2 3 4 5	Improve reliability and timeliness of cash (spot) market price information so I can make better **farm level management and investment** decisions.	NA 1 2 3 4 5
NA 1 2 3 4 5	Improve accuracy of market information about the type of animals buyers are requesting so I can make better **marketing** decisions.	NA 1 2 3 4 5
NA 1 2 3 4 5	Improve accuracy of market information about the type of animals buyers are requesting so I can make better **farm level management and investment** decisions.	NA 1 2 3 4 5
NA 1 2 3 4 5	Reduce transportation costs and time required for **delivering my livestock** to point of sale.	NA 1 2 3 4 5
NA 1 2 3 4 5	Reduce transportation costs and time required to **source feeder livestock** fed on my farm.	NA 1 2 3 4 5
NA 1 2 3 4 5	Reduce cost and time required to **obtain a loan** needed to finance my farming operation.	NA 1 2 3 4 5
NA 1 2 3 4 5	Increase local competition for the **sale of the livestock** I produce on my farm.	NA 1 2 3 4 5
NA 1 2 3 4 5	Increase local sources for **feeder livestock** fed on my farm.	NA 1 2 3 4 5
NA 1 2 3 4 5	Increase local competition for **providing the loans** needed to finance my farming operation.	NA 1 2 3 4 5
NA 1 2 3 4 5	Offer **better marketing or production contract terms** for the livestock I produce.	NA 1 2 3 4 5
NA 1 2 3 4 5	Capture price advantages from **volume selling** by pooling cooperative member livestock sales.	NA 1 2 3 4 5
NA 1 2 3 4 5	Capture price advantages from **volume buying** by pooling cooperative member livestock purchases.	NA 1 2 3 4 5

11) Please indicate how important each of the following risk management objectives of UPI is to you and how effectively you feel UPI is fulfilling these objectives.

How important is this UPI objective to the success of your farming operation?	**Cooperative's Risk Management Objective**	**How effectively has UPI fulfilled this objective?**
N.A. = Not Applicable ***Very Unimportant = 1*** ***Very Important =5***		
NA 1 2 3 4 5	Reduce variability in the **prices I receive for livestock produced** on my farm.	NA 1 2 3 4 5
NA 1 2 3 4 5	Reduce variability in the **prices I pay for buying feeder livestock** fed on my farm.	NA 1 2 3 4 5
NA 1 2 3 4 5	Reduce variability in the **interest rate for the loans** needed to finance my farming operation.	NA 1 2 3 4 5
NA 1 2 3 4 5	Ensure a reliable market outlet for the **livestock I produce** on my farm.	NA 1 2 3 4 5
NA 1 2 3 4 5	Ensure a reliable source for the **feeder livestock I purchase** and feed on my farm.	NA 1 2 3 4 5
NA 1 2 3 4 5	Ensure a reliable source for the **loans needed** to finance my farming operation.	NA 1 2 3 4 5
NA 1 2 3 4 5	Reduce the possibility that the end users I **sell livestock to** can take advantage of market changes at my expense.	NA 1 2 3 4 5
NA 1 2 3 4 5	Reduce the possibility that businesses I **buy feeder livestock from** can take advantage of market changes at my expense.	NA 1 2 3 4 5
NA 1 2 3 4 5	Reduce the possibility that the lenders I **borrow money from** can take advantage of market changes at my expense.	NA 1 2 3 4 5
NA 1 2 3 4 5	Other (please list)	NA 1 2 3 4 5

12) What **change** would you expect to see in the **prices you receive for your livestock,** if UPI's facilities and services were not available to provide market competition (check only one item per row).

Expected Change in Local Market Prices for:	No noticeable change	Less than **5% decrease** in price	Between **5% and 10% decrease** in price	More than **10% decrease** in price	Not Applicable
Beef Cows	☐	☐	☐	☐	☐
Beef Calves (600 # or less)	☐	☐	☐	☐	☐
Feeder Cattle (601 # to 800 #)	☐	☐	☐	☐	☐
Fed Cattle (801 # or heavier)	☐	☐	☐	☐	☐
Beef Bulls	☐	☐	☐	☐	☐
Sows & Boars	☐	☐	☐	☐	☐
Feeder Pigs	☐	☐	☐	☐	☐
Finished Hogs	☐	☐	☐	☐	☐
Dairy Cows	☐	☐	☐	☐	☐
Veal Calves	☐	☐	☐	☐	☐
Replacement Dairy Heifers	☐	☐	☐	☐	☐
Ewes & Rams	☐	☐	☐	☐	☐
Feeder Lambs	☐	☐	☐	☐	☐
Fed Lambs	☐	☐	☐	☐	☐
Goats	☐	☐	☐	☐	☐
Other:	☐	☐	☐	☐	☐
Other:	☐	☐	☐	☐	☐

13) How much would the costs for transporting and delivering your livestock to point of sale **change** if you did business with an alternative company?

Cost Increase of _____$/year

OR

Cost Decrease of _____$/year

14) During the past 12 months, has UPI has made any **special efforts to enhance the efficiency or profitability** of your farming operation?

☐ No⟶ **If *NO* go to question 15.**

☐ Yes ⟶ Please provide a brief description of the situation and what UPI did.

_____
_____
_____
_____
_____

How much value did this special effort create for you? _____$

15) During the past 12 months, has UPI has made any **special efforts to reduce the risk or uncertainty** confronting your farming operation?

☐ No⟶ **If NO Go to question 16.**

☐ Yes ⟶ Please provide a brief description of the situation and what UPI did.

_____
_____
_____
_____
_____

How much value did this special effort create for you? _____$

16) How strongly do you agree or disagree with the following statements?

The primary function of UPI is to:	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Enhance the profitability of my current farming operation without regard to any community level benefits.	1	2	3	4	5
Support the economic success of the community, even if it results in reduced cooperative level performance.	1	2	3	4	5
Develop and maintain high quality jobs within the community, even if it results in reduced cooperative level performance.	1	2	3	4	5
Develop and train individuals to be strong community leaders.	1	2	3	4	5
Create opportunities for members to network with other agricultural leaders and decision makers.	1	2	3	4	5

17) How important is each of the following items in your decision to patronize UPI?

How important is this item in your decision to patronize UPI?	*N.A. = Not Applicable* *Very Unimportant = 1* *Very Important =5*
The $20.00 per year preferred membership fee required to access preferred membership benefits.	NA 1 2 3 4 5
The 0.25% interest rate discount on loans to finance livestock marketed through UPI, as a preferred member	NA 1 2 3 4 5
Discounted tariff schedules on livestock marketed through UPI, as a preferred member	NA 1 2 3 4 5
Access to management and consulting services, as a preferred member.	NA 1 2 3 4 5
The potential to receive future patronage allocations.	NA 1 2 3 4 5
Ability to maintain voting privileges and influence cooperative decision making.	NA 1 2 3 4 5
Ability to elect peers as district delegates.	NA 1 2 3 4 5
Ability to elect peers to the board of directors.	NA 1 2 3 4 5
The $0.75/head investment/retain for cattle marketed.	NA 1 2 3 4 5
The $0.25/head investment/retain for swine (hogs), sheep and goats marketed.	NA 1 2 3 4 5
The $0.50/head investment/retain for other species marketed.	NA 1 2 3 4 5
The five year time period for maintaining the accumulated investment/retains.	NA 1 2 3 4 5
The $2,500 per member cap on total accumulated investment/retains.	NA 1 2 3 4 5

18) When you have a concern about how the cooperative is being operated, do you: (check all that apply)

☐ Contact the nearest district delegate.

☐ Contact a member of the board of directors.

☐ Contact the manager of the nearest branch location.

☐ Contact one of the cooperative's employees at the nearest branch location.

☐ Contact the cooperative's senior management in Columbus, Ohio.

☐ Do nothing.

19) If your retained cooperative investment were redeemed in a lump sum, how would you use these funds? (check only one)

☐ Pay down short term debt.

☐ Pay down long term debt

☐ Reinvest in current farming operation.

☐ Use for family living expenses.

☐ Invest in Certificate of Deposit.

☐ Invest in Mutual Fund.

☐ Other:_____

20) How many acres of crop land do you currently farm?

Crop	**Planted Acres in 2005**	**Average Yield per Acre in 2005**
Corn – Grain		Bu./A
Corn – Silage		Tons/A
Soybeans		Bu./A
Winter Wheat		Bu./A
Spring Wheat		Bu./A
Grain Sorghum – Grain		Bu./A
Grain Sorghum – Silage		Tons/A
Alfalfa **(for sale to others)**		Tons/A
Hay **(for sale to others)**		Tons/A
Other:		Units____
Other:		Units____
Other:		Units____
Total Crop Land		

21) How many head of livestock do you currently have on your farm?

Species	Number of Head Currently on your farm	Number of Head Sold or Culled in 2005	Number of Head Sold/Culled Through UPI in 2005
Beef Cows	Hd.	Hd.	Hd.
Beef Calves (600 # or less)	Hd.	Hd.	Hd.
Feeder Cattle (601 # to 800 #)	Hd.	Hd.	Hd.
Fed Cattle (801 # or heavier)	Hd.	Hd.	Hd.
Beef Bulls	Hd.	Hd.	Hd.
Sows & Boars	Hd.	Hd.	Hd.
Feeder Pigs	Hd.	Hd.	Hd.
Finished Hogs	Hd.	Hd.	Hd.
Dairy Cows	Hd.	Hd.	Hd.
Veal Calves	Hd.	Hd.	Hd.
Replacement Dairy Heifers	Hd.	Hd.	Hd.
Ewes & Rams	Hd.	Hd.	Hd.
Feeder Lambs	Hd.	Hd.	Hd.
Fed Lambs	Hd.	Hd.	Hd.
Goats	Hd.	Hd.	Hd.
Other:	Hd.	Hd.	Hd.
Other:	Hd.	Hd.	Hd.

22) Which of the following best describes your current farm business strategy? (check all that apply)

☐ Maintain current farm size and enterprise mix

☐ Grow farm operation through **increased acreage of existing crop enterprises.**

☐ Grow farm operation through **increased head of existing livestock enterprises.**

☐ Grow farm operation through **adding value to current commodities produced.**

☐ Grow farm operation through **adding a new farm enterprise (crop or livestock).**

☐ Grow farm operation through **increased efficiencies or reduced costs.**

☐ Reduce acreage of existing crop enterprises.

☐ Reduce head within existing livestock enterprises.

☐ Transition the farm operation to the next generation.

☐ Transition out of active farming.

23) What percentage of your total household income comes from the following sources?

Net Farm Income _____ %
Non-Farm Income _____ %

Total 100 %

24) Under what legal form is your farm organized?

☐ Sole Proprietor ☐ Partnership ☐ Farming Corporation ☐ LLC

25) Which category best represents the annual gross sales from your total farming operation?

☐ Less than $9,999

☐ $10,000 to $99,999

☐ $100,000 to $249,999

☐ $250,000 to $499,999

☐ $500,000 to $749,999

☐ $750,000 or more.

26) Which category best represents your current net worth?

☐ Less than $9,999

☐ $10,000 to $99,999

☐ $100,000 to $249,999

☐ $250,000 to $499,999

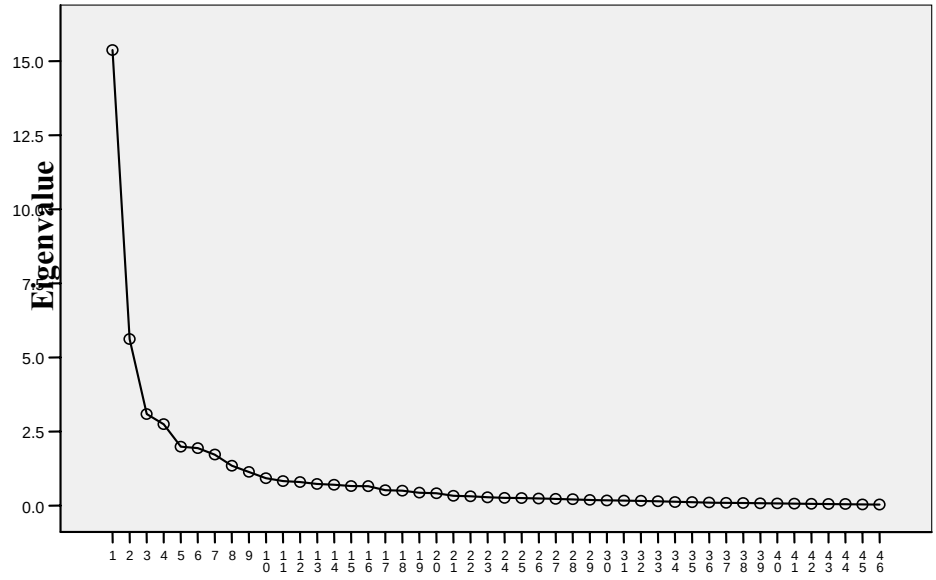
☐ $500,000 or more

Thank You for Your Participation !

APPENDIX B

Exploratory Factor Analysis Results

Appendix Figure B1: Scree Plot of Exploratory Factor Analysis of UPI Survey Questions 10 and 11



Appendix Table B1: Communalities of UPI Survey Questions 10 and 11.

Survey Question	Initial	Extraction
Q10a1: Price Info. for Marketing	1.000	.698
Q10b1: Price Info. for Management	1.000	.685
Q10c1: Animal Info. for Marketing	1.000	.695
Q10d1: Animal Info for Management	1.000	.694
Q10e1: Lower Cost for Delivery	1.000	.358
Q10f1: Lower Costs to Source Feeder	1.000	.582
Q10g1: Lower Costs to Source Loans	1.000	.770
Q10h1: More Competition for Sales	1.000	.444
Q10i1: More Competition for Purchases	1.000	.596
Q10j1: More Competition for Loans	1.000	.749
Q10k1: Better Contract Terms	1.000	.469

Appendix Table B1: (cont.) Communalities of UPI Survey Questions 10 and 11.

Survey Question	Initial	Extraction
Q10l1: Capture Volume Selling	1.000	.711
Q10m1: Capture Volume Buying	1.000	.660
Q10a2: Price Info. for Marketing	1.000	.715
Q10b2: Price Info. for Management	1.000	.725
Q10c2: Animal Info. for Marketing	1.000	.745
Q10d2: Animal Info for Management	1.000	.741
Q10e2: Lower Cost for Delivery	1.000	.453
Q10f2: Lower Costs to Source Feeder	1.000	.644
Q10g2: Lower Costs to Source Loans	1.000	.763
Q10h2: More Competition for Sales	1.000	.493
Q10i2: More Competition for Purchases	1.000	.619
Q10j2: More Competition for Loans	1.000	.757
Q10k2: Better Contract Terms	1.000	.474
Q10l2: Capture Volume Selling	1.000	.725
Q10m2: Capture Volume Buying	1.000	.648
Q11a1: Reduce Sales Price Risk	1.000	.605
Q11b1: Reduce Purchase Price Risk	1.000	.808
Q11c1: Reduce Interest Rate Risk	1.000	.746
Q11d1: Ensure Reliable Output Market	1.000	.636
Q11e1: Ensure Reliable Input Market	1.000	.792
Q11f1: Ensure Reliable Source for Loans	1.000	.828
Q11g1: Limit Opportunistic Buyers	1.000	.414

Appendix Table B1: (cont.) Communalities of UPI Survey Questions 10 and 11.

Survey Question	Initial	Extraction
Q11h1: Limit Opportunistic Sellers	1.000	.759
Q11i1: Limit Opportunistic Lenders	1.000	.656
Q11j1: Other	1.000	.032
Q11a2: Reduce Sales Price Risk	1.000	.474
Q11b2: Reduce Purchase Price Risk	1.000	.751
Q11c2: Reduce Interest Rate Risk	1.000	.754
Q11d2: Ensure Reliable Output Market	1.000	.459
Q11e2: Ensure Reliable Input Market	1.000	.778
Q11f2: Ensure Reliable Source for Loans	1.000	.824
Q11g2: Limit Opportunistic Buyers	1.000	.385
Q11h2: Limit Opportunistic Sellers	1.000	.722
Q11i2: Limit Opportunistic Lenders	1.000	.685
Q11j2: Other	1.000	.089

Extraction Method: Principal Component Analysis.

Appendix Table B2: Promax Structure Matrix for Exploratory Factor Analysis of Survey of UPI Survey Questions 10 and 11.

Survey Question	Component				
	1	2	3	4	5
Q10a1	.228	.268	.492	.790	.064
Q10b1	.250	.288	.543	.760	.076
Q10c1	.202	.282	.502	.790	.085
Q10d1	.208	.282	.509	.794	.137
Q10e1	.273	.394	.382	.449	.403
Q10f1	.433	.756	.360	.280	.314

Appendix Table B2 (cont.): Promax Structure Matrix for Exploratory Factor Analysis of Survey of UPI Survey Questions 10 and 11.

Survey Question	Component				
	1	2	3	4	5
Q10g1	.872	.488	.199	.182	.313
Q10h1	.131	.185	.257	.607	.382
Q10i1	.366	.746	.259	.324	.371
Q10j1	.848	.427	.199	.263	.333
Q10l1	.254	.250	.281	.457	.780
Q10m1	.396	.438	.163	.330	.767
Q10a2	.264	.300	.808	.457	.053
Q10b2	.260	.280	.814	.449	.049
Q10c2	.307	.406	.851	.393	.164
Q10d2	.298	.370	.855	.383	.174
Q10e2	.264	.441	.586	.197	.401
Q10f2	.459	.739	.528	.118	.296
Q10g2	.862	.476	.359	.095	.287
Q10h2	.176	.285	.647	.236	.395
Q10i2	.450	.746	.487	.168	.350
Q10j2	.860	.455	.359	.115	.341
Q10k2	.518	.416	.541	.270	.444
Q10l2	.335	.268	.551	.191	.745
Q10m2	.450	.462	.409	.160	.747
Q11a1	.074	.163	.226	.737	.346
Q11b1	.442	.872	.177	.308	.285

Appendix Table B2 (cont.): Promax Structure Matrix for Exploratory Factor Analysis of Survey of UPI Survey Questions 10 and 11.

Survey Question	Component				
	1	2	3	4	5
Q11c1	.837	.550	.158	.234	.358
Q11d1	.050	.147	.231	.769	.294
Q11e1	.423	.870	.199	.277	.255
Q11f1	.897	.499	.172	.218	.334
Q11g1	.193	.233	.209	.629	.243
Q11h1	.457	.851	.215	.322	.280
Q11j1	.129	-.012	-.003	.022	-.032
Q11a2	.153	.178	.637	.204	.355
Q11b2	.508	.850	.369	.095	.285
Q11c2	.847	.487	.297	.005	.355
Q11d2	.102	.185	.624	.354	.304
Q11e2	.475	.867	.370	.114	.234
Q11f2	.899	.476	.313	.069	.309
Q11g2	.278	.248	.592	.267	.308
Q11h2	.522	.827	.444	.140	.288
Q11i2	.819	.502	.338	.112	.303
Q11j2	.223	.034	.124	-.075	.011

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.

Appendix Table B3: Component Correlation Matrix for Exploratory Factor Analysis of Survey of UPI Survey Questions 10 and 11.

Component	1	2	3	4	5
1	1.000	.561	.321	.190	.358
2	.561	1.000	.383	.267	.356
3	.321	.383	1.000	.361	.242
4	.190	.267	.361	1.000	.207
5	.358	.356	.242	.207	1.000

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.

Appendix Table B4: Varimax Rotated Component Matrix Exploratory Factor Analysis of Survey of UPI Survey Questions 10 and 11.

Survey Question	Component				
	1	2	3	4	5
Q10a1: Price Info. for Marketing	.106	.107	.347	.737	-.111
Q10b1: Price Info. for Management	.121	.119	.404	.694	-.106
Q10c1: Animal Info. for Marketing	.067	.128	.358	.734	-.087
Q10d1: Animal Info for Management	.069	.120	.364	.736	-.033
Q10e1: Lower Cost for Delivery	.107	.265	.251	.372	.273
Q10f1: Lower Costs to Source Feeder	.196	.683	.187	.169	.115
Q10g1: Lower Costs to Source Loans	.824	.260	.020	.107	.104
Q10h1: More Competition for Sales	.014	.056	.131	.578	.298
Q10i1: More Competition for Purchases	.121	.696	.073	.232	.194
Q10j1: More Competition for Loans	.811	.183	.017	.198	.131
Q10k1: Better Contract Terms	.361	.216	.102	.463	.259
Q10l1: Capture Volume Selling	.104	.075	.152	.397	.717
Q10m1: Capture Volume Buying	.227	.291	.000	.266	.673

Appendix Table B4: (cont.) Varimax Rotated Component Matrix Exploratory Factor Analysis of Survey of UPI Survey Questions 10 and 11.

Survey Question	Component				
	1	2	3	4	5
Q10a2: Price Info. for Marketing	.123	.125	.749	.327	-.129
Q10b2: Price Info. for Management	.126	.102	.762	.319	-.129
Q10c2: Animal Info. for Marketing	.128	.231	.785	.240	-.027
Q10d2: Animal Info for Management	.128	.189	.797	.231	-.009
Q10e2: Lower Cost for Delivery	.072	.321	.516	.065	.272
Q10f2: Lower Costs to Source Feeder	.224	.650	.402	-.030	.096
Q10g2: Lower Costs to Source Loans	.809	.237	.218	-.010	.074
Q10h2: More Competition for Sales	.012	.147	.611	.109	.293
Q10i2: More Competition for Purchases	.209	.656	.347	.028	.154
Q10j2: More Competition for Loans	.806	.206	.216	.011	.135
Q10k2: Better Contract Terms	.380	.211	.430	.149	.280
Q10l2: Capture Volume Selling	.183	.065	.489	.067	.666
Q10m2: Capture Volume Buying	.269	.289	.295	.042	.635
Q11a1: Reduce Sales Price Risk	-.045	.041	.084	.726	.261
Q11b1: Reduce Purchase Price Risk	.187	.847	-.041	.222	.077
Q11c1: Reduce Interest Rate Risk	.760	.341	-.042	.164	.149
Q11d1: Ensure Reliable Output Market	-.065	.030	.090	.761	.207
Q11e1: Ensure Reliable Input Market	.166	.853	-.008	.185	.049

Appendix Table B4: (cont.) Varimax Rotated Component Matrix Exploratory Factor Analysis of Survey of UPI Survey Questions 10 and 11.

Survey Question	Component				
	1	2	3	4	5
Q11f1: Ensure Reliable Source for Loans	.849	.264	-.021	.149	.121
Q11g1: Limit Opportunistic Buyers	.089	.113	.064	.610	.131
Q11h1: Limit Opportunistic Sellers	.208	.811	.001	.232	.068
Q11i1: Limit Opportunistic Lenders	.710	.309	-.011	.216	.100
Q11j1: Other	.160	-.052	-.018	.024	-.055
Q11a2: Reduce Sales Price Risk	.026	.031	.625	.087	.273
Q11b2: Reduce Purchase Price Risk	.263	.795	.207	-.037	.075
Q11c2: Reduce Interest Rate Risk	.788	.266	.162	-.099	.162
Q11d2: Ensure Reliable Output Market	-.036	.047	.590	.250	.211
Q11e2: Ensure Reliable Input Market	.223	.828	.207	-.015	.019
Q11f2: Ensure Reliable Source for Loans	.855	.234	.166	-.031	.098
Q11g2: Limit Opportunistic Buyers	.159	.083	.541	.157	.189
Q11h2: Limit Opportunistic Sellers	.278	.748	.284	.001	.069
Q11i2: Limit Opportunistic Lenders	.748	.281	.191	.009	.095
Q11j2: Other	.245	-.035	.123	-.105	-.031

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a Rotation converged in 6 iterations.

APPENDIX C

Summary Statistics and Confirmatory Factor Analysis Results for Latent Variables Used to Test Research Hypothesis 2

Appendix Table C1: Pearson Correlation Coefficients for Survey Questions Used as Manifest Indicator Variables for the *Free Riding* Latent Variable.[1]

Variable	Q9a	Q9b	Q9c	Q9g	Q9i	Q9k	Q18
Q9a	1.00	0.517	-0.245	0.364	0.363	0.283	-0.255
Q9b	0.517	1.00	-0.129	0.257	0.221	0.156	-0.117
Q9c	-0.245	-0.129	1.00	-0.054	-0.048	-0.047	0.075
Q9g	0.364	0.257	-0.054	1.00	0.431	0.353	-0.240
Q9i	0.363	0.221	-0.048	0.431	1.00	0.555	-0.299
Q9k	0.283	0.156	-0.047	0.353	0.555	1.00	-0.303
Q18	-0.255	-0.117	0.075	-0.240	-0.299	-0.303	1.00

1 Coefficients estimated using pairwise deletion for missing data.

Appendix Table C2: Pearson Correlation Coefficients for Survey Questions Used as Manifest Indicator Variables for the *Importance of Cooperative's By-Law and Policies* Latent Variable.[1]

Variable[1]	Q17a	Q17b	Q17c	Q17d	Q17e	Q17f	Q17g	Q17h	Q17i	Q17j	Q17k	Q17l	Q17m
Q17a	1.00	0.325	0.393	0.341	0.432	0.409	0.404	0.387	0.448	0.193	0.227	0.442	0.424
Q17b	0.325	1.00	0.522	0.474	0.364	0.353	0.337	0.316	0.288	0.187	0.316	0.308	0.338
Q17c	0.393	0.522	1.00	0.628	0.576	0.537	0.507	0.487	0.363	0.158	0.210	0.474	0.503
Q17d	0.341	0.474	0.628	1.00	0.672	0.557	0.518	0.492	0.326	0.218	0.197	0.428	0.470
Q17e	0.432	0.364	0.576	0.672	1.00	0.730	0.686	0.675	0.416	0.156	0.162	0.561	0.504
Q17f	0.409	0.353	0.537	0.557	0.730	1.00	0.917	0.904	0.403	0.204	0.221	0.567	0.528
Q17g	0.404	0.337	0.507	0.518	0.686	0.917	1.00	0.955	0.402	0.187	0.218	0.550	0.484
Q17h	0.387	0.316	0.487	0.492	0.675	0.904	0.955	1.00	0.394	0.170	0.193	0.549	0.486
Q17i	0.448	0.288	0.363	0.326	0.416	0.403	0.402	0.394	1.00	-0.094	0.254	0.435	0.382
Q17j	0.193	0.187	0.158	0.218	0.156	0.204	0.187	0.170	-0.094	1.00	0.569	0.279	0.249
Q17k	0.227	0.316	0.210	0.197	0.162	0.221	0.218	0.193	0.254	0.569	1.00	0.285	0.232
Q17l	0.442	0.308	0.474	0.428	0.561	0.567	0.550	0.549	0.435	0.279	0.285	1.00	0.695
Q17m	0.424	0.338	0.503	0.470	0.504	0.528	0.484	0.486	0.382	0.249	0.232	0.695	1.00

1 Coefficients estimated using pairwise deletion for missing data.

Appendix Table C3: Summary Statistics for Survey Questions Used as Manifest Indicator Variables for the *Importance of Seller Benefits* Latent Variable.

Variable [1]	Not Applicable 0	Very Unimportant 1	2	3	4	Very Important 5	Missing	Mean	Variance
Q10a1	45	41	26	107	142	150	64	3.39	2.47
Q10b1	55	39	34	135	120	122	70	3.17	2.45
Q10c1	40	34	40	95	140	157	69	3.45	2.38
Q10d1	44	38	35	106	140	141	71	3.36	2.43
Q10e1	70	42	36	82	126	153	66	3.20	3.05
Q10h1	38	33	32	66	128	210	68	3.66	2.47
Q10k1	160	40	22	85	91	102	75	2.43	3.91
Q11a1	21	44	27	99	136	170	78	3.60	2.08
Q11d1	10	41	10	39	111	294	70	4.14	1.77
Q11g1	56	38	23	72	124	184	78	3.45	2.90

1 The items in Questions 10 and 11 were ordered alphabetically from top to bottom, while the column for importance to the success of the farm labeled as one and the column for how effectively the cooperative fulfilled this objective being labeled as a two.

Appendix Table C4: Pearson Correlation Coefficients for Survey Questions Used as Manifest Indicator Variables for the *Importance of Seller Benefits* Latent Variable.

Variable [1]	Q10a1	Q10b1	Q10c1	Q10d1	Q10e1	Q10h1	Q10k1	Q11a1	Q11d1	Q11g1
Q10a1	1.00	0.803	0.671	0.617	0.356	0.359	0.371	0.438	0.430	0.362
Q10b1	0.803	1.00	0.646	0.675	0.314	0.319	0.388	0.398	0.378	0.350
Q10c1	0.671	0.646	1.00	0.862	0.362	0.410	0.368	0.465	0.453	0.364
Q10d1	0.617	0.675	0.862	1.00	0.334	0.411	0.403	0.447	0.460	0.386
Q10e1	0.356	0.314	0.362	0.334	1.00	0.304	0.405	0.319	0.323	0.232
Q10h1	0.359	0.319	0.410	0.411	0.304	1.00	0.277	0.517	0.506	0.441
Q10k1	0.371	0.388	0.368	0.403	0.405	0.277	1.00	0.325	0.324	0.283
Q11a1	0.438	0.398	0.465	0.447	0.319	0.517	0.325	1.00	0.642	0.556
Q11d1	0.430	0.378	0.453	0.460	0.323	0.506	0.324	0.642	1.00	0.563
Q11g1	0.362	0.350	0.364	0.386	0.232	0.441	0.283	0.556	0.563	1.00

1 Coefficients estimated using pairwise deletion for missing data.

Appendix Table C5: Unstandardized Factor Loadings, Standardized Factor Loadings, Estimated Standard Errors, Critical Ratios, *P* Values and Squared Multiple Correlations for the *Importance of Seller Benefits* Confirmatory Factor Analysis Model.

Manifest Variable[1]	Untandardized Factor Loadings	Standardized Factor Loading	Estimated Standard Error	*z* Critical Ratio[2]	*P* Value	Squared Multiple Correlation
Q10a1	1.042	0.663	0.066	15.883	***	0.439
Q10b1	0.998	0.626	0.068	14.710	***	0.392
Q10c1	1.069	0.692	0.064	16.774	***	0.479
Q10d1	1.058	0.680	0.065	16.354	***	0.462
Q10e1	0.819	0.469	0.078	10.456	***	0.220
Q10h1	0.987	0.629	0.067	14.803	***	0.396
Q10k1	0.989	0.500	0.089	11.148	***	0.250
Q11a1	1.097	0.760	0.058	18.928	***	0.578
Q11d1	0.997	0.749	0.053	18.654	***	0.561
Q11g1	1.106	0.650	0.072	15.328	***	0.423
e10a1-e10b1[3]	0.974[5]	0.666[6]	0.090	10.824	***	N.A.
e10c1-e10d1[4]	0.642[5]	0.659[6]	0.066	9.803	***	N.A.

*** Indicates a *P* value of less than 0.001 (two-tailed)

1 The items in Questions 10 and 11 were ordered alphabetically from top to bottom, while the column for importance to the success of the farm labeled as one and the column for how effectively the cooperative fulfilled this objective being labeled as a two.

2 This model has 34 degrees of freedom

3 Correlation between the error terms of Q10a1 and Q10b1

4 Correlation between the error terms of Q10c1 and Q10d1

5 Estimated Covariance

6 Estimated Correlation coefficient

Appendix Table C6: Selected Model Fit Indices for the *Importance of Seller Benefits* Confirmatory Factor Analysis Model.

Fit Index	Estimated Model Value	Recommended Value
χ^2_m	281.017[1]	Value heavily influenced by sample size. No general recommendation
Root-Mean-Square Error of Approximation (RMSEA)	0.114[2]	0.05 or less = close fit 0.05 ≤ value ≤ 0.08 = good fit Value ≥ 0.10 poor fit
Akaike Information Criterion (AIC)	345.017	Used to rank nested models with same structure. Smaller values indicate better fit.
Normed Fit Index (NFI)	0.898	0.90 or greater = good fit
Comparative Fit Index (CFI)	0.908	0.90 or greater = good fit
Tucker-Lewis Index (TLI)	0.847	0.95 or greater = superior fit

1 This model has 34 degrees of freedom. The *p* value was less than 0.001 so H_o is not rejected.

2 90 % confidence interval = 0.102 to 0.127

Appendix Table C7: Summary Statistics for Survey Questions Used as Manifest Indicator Variables for the *Provision of Seller Benefits* Latent Variable.

Variable[1]	Not Applicable 0	Very Unimportant 1	2	3	4	Very Important 5	Missing	Mean	Variance
Q10a2	51	33	54	179	142	73	43	3.03	2.03
Q10b2	60	40	58	186	115	60	56	2.84	2.12
Q10c2	42	48	68	149	153	62	53	2.98	1.99
Q10d2	42	58	63	163	138	54	57	2.89	1.97
Q10e2	81	51	47	129	112	103	52	2.86	2.86
Q10h2	42	51	67	153	124	85	53	3.00	2.14
Q10k2	153	50	46	140	77	39	70	2.11	2.89
Q11a2	28	49	66	211	113	47	61	2.92	1.59
Q11d2	15	32	45	107	168	158	50	3.63	1.72
Q11g2	59	41	67	167	113	54	74	2.79	2.14

1 The items in Questions 10 and 11 were ordered alphabetically from top to bottom, while the column for importance to the success of the farm labeled as one and the column for how effectively the cooperative fulfilled this objective being labeled as a two.

Appendix Table C8: Pearson Correlation Coefficients for Survey Questions Used as Manifest Indicator Variables for the *Provision of Seller Benefits* Latent Variable.

Variable [1]	Q10a2	Q10b2	Q10c2	Q10d2	Q10e2	Q10h2	Q10k2	Q11a2	Q11d2	Q11g2
Q10a2	1.00	0.820	0.671	0.625	0.339	0.421	0.377	0.417	0.408	0.387
Q10b2	0.820	1.00	0.674	0.693	0.369	0.395	0.394	0.405	0.372	0.364
Q10c2	0.671	0.674	1.00	0.866	0.415	0.464	0.382	0.483	0.440	0.408
Q10d2	0.625	0.693	0.866	1.00	0.425	0.489	0.421	0.440	0.398	0.372
Q10e2	0.339	0.369	0.415	0.425	1.00	0.424	0.370	0.338	0.355	0.322
Q10h2	0.421	0.395	0.464	0.489	0.424	1.00	0.299	0.491	0.444	0.425
Q10k2	0.377	0.394	0.382	0.421	0.370	0.299	1.00	0.319	0.316	0.335
Q11a2	0.417	0.405	0.483	0.440	0.338	0.491	0.319	1.00	0.508	0.497
Q11d2	0.408	0.372	0.440	0.398	0.355	0.444	0.316	0.508	1.00	0.491
Q11g2	0.387	0.364	0.408	0.372	0.322	0.425	0.335	0.497	0.491	1.00

1 Coefficients estimated using pairwise deletion for missing data.

Appendix Table C9: Unstandardized Factor Loadings, Standardized Factor Loadings, Estimated Standard Errors, Critical Ratios, *P* Values and Squared Multiple Correlations for the *Provision of Seller Benefits* Confirmatory Factor Analysis Model.

Manifest Variable[1]	Untandardized Factor Loadings	Standardized Factor Loading	Estimated Standard Error	*z* Critical Ratio[2]	*P* Value	Squared Multiple Correlation
Q10a2	1.011	0.711	0.057	17.719	***	0.506
Q10b2	1.037	0.714	0.058	17.731	***	0.510
Q10c2	1.101	0.777	0.055	19.981	***	0.604
Q10d2	1.056	0.750	0.056	18.924	***	0.563
Q10e2	0.941	0.557	0.073	12.956	***	0.310
Q10h2	0.950	0.651	0.061	15.698	***	0.423
Q10k2	0.890	0.524	0.075	11.866	***	0.274
Q11a2	0.843	0.669	0.052	16.173	***	0.448
Q11d2	0.824	0.628	0.055	15.030	***	0.394
Q11g2	0.897	0.613	0.063	14.305	***	0.375
e10a2 – e10b2[3]	0.645[5]	0.634[6]	0.065	9.874	***	N.A.
e10c2 – e10d2[4]	0.567[5]	0.684[6]	0.059	9.548	***	N.A.

*** Indicates a *P* value of less than 0.001 (two-tailed)

1 The items in Questions 10 and 11 were ordered alphabetically from top to bottom, while the column for importance to the success of the farm labeled as one and the column for how effectively the cooperative fulfilled this objective being labeled as a two.

2 This model has 33 degrees of freedom

3 Correlation between the error terms of Q10a2 and Q10b2

4 Correlation between the error terms of Q10c2 and Q10d2

5 Estimated Covariance

6 Estimated Correlation coefficient

Appendix Table C10: Selected Model Fit Indices for the *Provision of Seller Benefits* Confirmatory Factor Analysis Model.

Fit Index	Estimated Model Value	Recommended Value
χ^2_m	204.31[1]	Value heavily influenced by sample size. No general recommendation
Root-Mean-Square Error of Approximation (RMSEA)	0.095[2]	0.05 or less = close fit 0.05 ≤ value ≤ 0.08 = good fit Value ≥ 0.10 poor fit
Akaike Information Criterion (AIC)	268.31	Used to rank nested models with same structure. Smaller values indicate better fit.
Normed Fit Index (NFI)	0.927	0.90 or greater = good fit
Comparative Fit Index (CFI)	0.938	0.90 or greater = good fit
Tucker-Lewis Index (TLI)	0.896	0.95 or greater = superior fit

1 This model has 33 degrees of freedom. The *p* value was less than 0.001 so H_o is not rejected.

2 90 % confidence interval = 0.083 to 0.108

Appendix Table C11: Summary Statistics for Survey Questions Used as Manifest Indicator Variables for the *Provision of Desired Buyer Benefits* Latent Variable.

Variable[1]	Not Applicable 0	Very Unimportant 1	2	3	4	Very Important 5	Missing	Mean	Variance
Q10f1	183	39	22	77	90	90	74	2.24	3.98
Q10f2	183	35	44	110	83	53	67	2.07	3.32
Q10i1	169	46	26	74	89	92	79	2.29	3.92
Q10i2	160	49	42	120	97	33	74	2.09	2.98
Q11b1	211	43	16	75	72	83	75	2.01	4.00
Q11b2	202	35	54	125	58	24	77	1.75	2.79
Q11e1	218	41	9	52	71	110	74	2.09	4.47
Q11e2	209	34	32	95	79	53	73	1.92	3.50
Q11h1	223	34	16	64	64	102	72	2.04	4.31
Q11h2	215	32	44	124	53	33	74	1.73	2.98

1 The items in Questions 10 and 11 were ordered alphabetically from top to bottom, while the column for importance to the success of the farm labeled as one and the column for how effectively the cooperative fulfilled this objective being labeled as a two.

Appendix Table C12: Pearson Correlation Coefficients for Survey Questions Used as Manifest Indicator Variables for the *Provision of Desired Buyer Benefits* Latent Variable.

Variable [1]	Q10f1	Q10f2	Q10i1	Q10i2	Q11b1	Q11b2	Q11e1	Q11e2	Q11h1	Q11h2
Q10f1	1.00	0.830	0.568	0.474	0.586	0.522	0.577	0.513	0.567	0.501
Q10f2	0.830	1.00	0.480	0.591	0.510	0.588	0.493	0.581	0.491	0.570
Q10i1	0.568	0.480	1.00	0.778	0.623	0.492	0.624	0.519	0.565	0.485
Q10i2	0.474	0.591	0.778	1.00	0.533	0.584	0.515	0.621	0.506	0.592
Q11b1	0.586	0.510	0.623	0.533	1.00	0.809	0.793	0.686	0.761	0.653
Q11b2	0.522	0.588	0.492	0.584	0.809	1.00	0.665	0.773	0.639	0.763
Q11e1	0.577	0.493	0.624	0.515	0.793	0.665	1.00	0.837	0.774	0.651
Q11e2	0.513	0.581	0.519	0.621	0.686	0.773	0.837	1.00	0.689	0.763
Q11h1	0.567	0.491	0.565	0.506	0.761	0.639	0.774	0.689	1.00	0.818
Q11h2	0.501	0.570	0.485	0.592	0.653	0.763	0.651	0.763	0.818	1.00

1 Coefficients estimated using pairwise deletion for missing data

Appendix Table C13: Unstandardized Factor Loadings, Standardized Factor Loadings, Estimated Standard Errors, Critical Ratios, *P* Values and Squared Multiple Correlations for the *Provision of Desired Buyer Benefits* Confirmatory Factor Analysis Model.

Manifest Variable	Untandardized Factor Loadings	Standardized Factor Loading	Estimated Standard Error	*z* Critical Ratio[1]	*P* Value	Squared Multiple Correlation
Q10f1	1.315	0.658	0.079	16.578	***	0.433
Q10f2	1.159	0.632	0.073	15.776	***	0.399
Q10i1	1.321	0.666	0.079	16.729	***	0.444
Q10i2	1.130	0.647	0.070	16.155	***	0.418
Q11b1	1.749	0.870	0.071	24.748	***	0.757
Q11b2	1.427	0.849	0.060	23.709	***	0.720
Q11e1	1.857	0.877	0.074	25.091	***	0.769
Q11e2	1.636	0.873	0.066	24.938	***	0.763
Q11h1	1.769	0.853	0.074	23.952	***	0.727
Q11h2	1.453	0.839	0.062	23.301	***	0.704
e10f1-e10f2 [2]	1.532 [5]	0.717 [6]	0.118	12.983	***	N.A.
e10i1-e10i2 [3]	1.236 [5]	0.627 [6]	0.105	11.787	***	N.A.
e10f2-e10i1 [4]	0.445 [5]	0.235 [6]	0.052	8.619	***	N.A.

*** Indicates a *P* value of less than 0.001 (two-tailed)
1 This model has 32 degrees of freedom
2 Correlation between the error terms of Q10f1 and Q10f2
3 Correlation between the error terms of Q10i1 and Q10i2
4 Correlation between the error terms of Q10f2 and Q10i1
5 Estimated Covariance
6 Estimated Correlation coefficient

Appendix Table C14: Selected Model Fit Indices for the *Provision of Desired Buyer Benefits* Confirmatory Factor Analysis Model.

Fit Index	Estimated Model Value	Recommended Value
χ^2_m	882.85[1]	Value heavily influenced by sample size. No general recommendation
Root-Mean-Square Error of Approximation (RMSEA)	0.215[2]	0.05 or less = close fit 0.05 ≤ value ≤ 0.08 = good fit Value ≥ 0.10 poor fit
Akaike Information Criterion (AIC)	948.85	Used to rank nested models with same structure. Smaller values indicate better fit.
Normed Fit Index (NFI)	0.827	0.90 or greater = good fit
Comparative Fit Index (CFI)	0.831	0.90 or greater = good fit
Tucker-Lewis Index (TLI)	0.710	0.95 or greater = superior fit

1 This model has 35 degrees of freedom. The *p* value was less than 0.001 so H_o is not rejected.
2 90 % confidence interval = 0.203 to 0.228

Appendix Table C15: Summary Statistics for Survey Questions Used as Manifest Indicator Variables for the *Provision of Desired Borrower Benefits* Latent Variable.

Variable[1]	Not Applicable 0	Very Unimportant 1	2	3	4	Very Important 5	Missing	Mean	Variance
Q10g1	294	65	34	42	34	40	66	1.17	2.81
Q10g2	305	62	23	60	27	27	71	1.05	2.47
Q10j1	287	58	24	50	39	42	75	1.24	3.01
Q10j2	289	47	32	85	34	14	74	1.14	2.36
Q11c1	307	50	15	42	31	51	79	1.18	3.17
Q11c2	314	49	16	72	26	17	81	0.98	2.28
Q11f1	318	48	17	36	45	37	74	1.11	2.94
Q11f2	320	40	20	61	35	20	79	1.01	2.46
Q11i1	280	37	10	35	59	76	78	1.57	4.07
Q11i2	287	32	24	86	39	21	86	1.22	2.70

1 The items in Questions 10 and 11 were ordered alphabetically from top to bottom, while the column for importance to the success of the farm labeled as one and the column for how effectively the cooperative fulfilled this objective being labeled as a two.

Appendix Table C16: Pearson Correlation Coefficients for Survey Questions Used as Manifest Indicator Variables for the *Provision of Desired Borrower Benefits* Latent Variable.

Variable [1]	Q10g1	Q10g2	Q10j1	Q10j2	Q11c1	Q11c2	Q11f1	Q11f2	Q11i1	Q11i2
Q10g1	1.00	0.768	0.801	0.703	0.752	0.647	0.836	0.724	0.619	0.601
Q10g2	0.768	1.00	0.661	0.820	0.616	0.746	0.692	0.814	0.546	0.667
Q10j1	0.801	0.661	1.00	0.792	0.743	0.587	0.796	0.657	0.655	0.599
Q10j2	0.703	0.820	0.792	1.00	0.615	0.728	0.674	0.774	0.605	0.680
Q11c1	0.752	0.616	0.743	0.615	1.00	0.732	0.877	0.707	0.689	0.614
Q11c2	0.647	0.746	0.587	0.728	0.732	1.00	0.691	0.864	0.593	0.745
Q11f1	0.836	0.692	0.796	0.674	0.877	0.691	1.00	0.816	0.709	0.653
Q11f2	0.724	0.814	0.657	0.774	0.707	0.864	0.816	1.00	0.629	0.771
Q11i1	0.619	0.546	0.655	0.605	0.689	0.593	0.709	0.629	1.00	0.828
Q11i2	0.601	0.667	0.599	0.680	0.614	0.745	0.653	0.771	0.828	1.00

1 Coefficients estimated using pairwise deletion for missing data

Appendix Table C17: Unstandardized Factor Loadings, Standardized Factor Loadings, Estimated Standard Errors, Critical Ratios, *P* Values and Squared Multiple Correlations for the *Provision of Desired Borrower Benefits* Confirmatory Factor Analysis Model.

Manifest Variable	Untandardized Factor Loadings	Standardized Factor Loading	Estimated Standard Error	*z* Critical Ratio[1]	*P* Value	Squared Multiple Correlation
Q10g1	1.469	0.876	0.058	25.154	***	0.768
Q10g2	1.340	0.857	0.055	24.177	***	0.735
Q10j1	1.496	0.859	0.062	24.182	***	0.737
Q10j2	1.424	0.866	0.054	24.528	***	0.749
Q11c1	1.439	0.803	0.066	21.708	***	0.644
Q11c2	1.203	0.802	0.056	21.667	***	0.643
Q11f1	1.500	0.875	0.060	25.059	***	0.766
Q11f2	1.342	0.865	0.055	24.504	***	0.748
Q11i1	1.475	0.729	0.078	18.938	***	0.532
Q11i2	1.248	0.762	0.062	20.119	***	0.581
e11c1-e11c2 [2]	0.242 [7]	0.252 [8]	0.035	6.920	***	N.A.
e11c1-e11f1 [3]	0.535 [7]	0.604 [8]	0.052	10.360	***	N.A.
e11c2-e11f2 [4]	0.394 [7]	0.563 [8]	0.040	9.906	***	N.A.
e11f1-e11f2 [5]	0.149 [7]	0.231 [8]	0.026	5.734	***	N.A.
e11i1-e11i2 [6]	0.906 [7]	0.618 [8]	0.084	10.753	***	N.A.

*** Indicates a *P* value of less than 0.001 (two-tailed)
1 This model has 30 degrees of freedom
2 Correlation between the error terms of Q10c1 and Q10c2
3 Correlation between the error terms of Q10c1 and Q10f1
4 Correlation between the error terms of Q10c2 and Q10f2
5 Correlation between the error terms of Q10f1 and Q10f2
6 Correlation between the error terms of Q10i1 and Q10i2
7 Estimated Covariance
8 Estimated Correlation coefficient

Appendix Table C18: Selected Model Fit Indices for the *Provision of Desired Borrower Benefits* Confirmatory Factor Analysis Model.

Fit Index	Estimated Model Value	Recommended Value
χ^2_m	803.80[1]	Value heavily influenced by sample size. No general recommendation
Root-Mean-Square Error of Approximation (RMSEA)	0.212[2]	0.05 or less = close fit 0.05 ≤ value ≤ 0.08 = good fit Value ≥ 0.10 poor fit
Akaike Information Criterion (AIC)	837.80	Used to rank nested models with same structure. Smaller values indicate better fit.
Normed Fit Index (NFI)	0.868	0.90 or greater = good fit
Comparative Fit Index (CFI)	0.871	0.90 or greater = good fit
Tucker-Lewis Index (TLI)	0.764	0.95 or greater = superior fit

1 This model has 30 degrees of freedom. The *p* value was less than 0.001 so H_o is not rejected.
2 90 % confidence interval = 0.199 to 0.225

Appendix Table C19: Summary Statistics for Survey Questions Used as Manifest Indicator Variables for the *Provision of Volume Benefits* Latent Variable.

Variable[1]	Not Applicable 0	Very Unimportant 1	2	3	4	Very Important 5	Missing	Mean	Variance
Q10l1	99	52	30	88	116	117	73	2.84	3.93
Q10l2	103	60	68	127	98	58	61	2.45	2.75
Q10m1	170	51	31	87	82	81	73	2.21	3.70
Q10m2	164	53	60	127	68	36	67	1.98	2.82

1 The items in Questions 10 and 11 were ordered alphabetically from top to bottom, while the column for importance to the success of the farm labeled as one and the column for how effectively the cooperative fulfilled this objective being labeled as a two.

Appendix Table C20: Pearson Correlation Coefficients for Survey Questions Used as Manifest Indicator Variables for the *Provision of Volume Benefits* Latent Variable.

Variable [1]	Q10l1	Q10l2	Q10m1	Q10m2
Q10l1	1.00	0.711	0.643	0.501
Q10l2	0.711	1.00	0.458	0.666
Q10m1	0.643	0.458	1.00	0.772
Q10m2	0.501	0.666	0.772	1.00

1 Coefficients estimated using pairwise deletion for missing data

Appendix Table C21: Unstandardized Factor Loadings, Standardized Factor Loadings, Estimated Standard Errors, Critical Ratios, *P* Values and Squared Multiple Correlations for the *Provision of Volume Benefits* Confirmatory Factor Analysis Model.

Manifest Variable	Untandardized Factor Loadings	Standardized Factor Loading	Estimated Standard Error	*z* Critical Ratio[1]	*P* Value	Squared Multiple Correlation
Q10l1	1.329	0.722	0.074	17.847	***	0.521
Q10l2	1.210	0.728	0.066	18.225	***	0.530
Q10m1	1.612	0.837	0.073	22.002	***	0.701
Q10m2	1.459	0.867	0.063	23.249	***	0.752

*** Indicates a *P* value of less than 0.001 (two-tailed)
1 This model has 2 degrees of freedom

Appendix Table C22: Selected Model Fit Indices for the *Provision of Volume Benefits* Confirmatory Factor Analysis Model.

Fit Index	Estimated Model Value	Recommended Value
χ^2_m	364.64[1]	Value heavily influenced by sample size. No general recommendation
Root-Mean-Square Error of Approximation (RMSEA)	0.562[2]	0.05 or less = close fit 0.05 ≤ value ≤ 0.08 = good fit Value ≥ 0.10 poor fit
Akaike Information Criterion (AIC)	388.64	Used to rank nested models with same structure. Smaller values indicate better fit.
Normed Fit Index (NFI)	0.722	0.90 or greater = good fit
Comparative Fit Index (CFI)	0.722	0.90 or greater = good fit
Tucker-Lewis Index (TLI)	-0.392	0.95 or greater = superior fit

1 This model has 2 degrees of freedom. The *p* value was less than 0.001 so H_o is not rejected.
2 90 % confidence interval = 0.514 to 0.611

Appendix Table C23: Summary Statistics for Survey Questions Used as Manifest Indicator Variables for the *Member's Patronage Horizon* Latent Variable.

Variable[1]	Summary Statistic	Missing	Mean	Variance
Q5	Highest value = 88 Lowest value = 16	5	56.7	160.9
Q6	Highest value = 67 Lowest value = 1	10	32.0	191.7
Q7	Highest value = 65 Lowest value = 0	113	19.2	195.7
Q22i	No = 0 430 responses Yes = 1 111 responses	34	0.21	0.16
Q22j	No = 0 503 responses Yes = 1 38 responses	34	0.07	0.06

1 The items in Questions 22 were ordered alphabetically from top to bottom.

Appendix Table C24: Pearson Correlation Coefficients for Survey Questions Used as Manifest Indicator Variables for the *Member's Patronage Horizon* Latent Variable.

Variable [1]	Q5	Q6	Q7	Q22i	Q22j
Q5	1.00	0.746	0.307	0.295	0.185
Q6	0.746	1.00	0.420	0.300	0.112
Q7	0.307	0.420	1.00	0.186	0.000
Q22i	0.295	0.300	0.186	1.00	-0.032
Q22j	0.185	0.112	0.000	-0.032	1.00

1 Coefficients estimated using pairwise deletion for missing data

Appendix Table C25: Unstandardized Factor Loadings, Standardized Factor Loadings, Estimated Standard Errors, Critical Ratios, *P* Values and Squared Multiple Correlations for the *Member's Patronage Horizon* Confirmatory Factor Analysis Model.

Manifest Variable	Untandardized Factor Loadings	Standardized Factor Loading	Estimated Standard Error	*z* Critical Ratio[1]	*P* Value	Squared Multiple Correlation
Q5	10.286	0.810	0.537	19.163	***	0.656
Q6	12.801	0.923	0.588	21.776	***	0.853
Q7	6.338	0.451	0.658	9.633	***	0.203
Q22i	0.136	0.336	0.018	7.548	***	0.113
Q22j	0.035	0.137	0.012	3.019	0.003	0.019

*** Indicates a *P* value of less than 0.001 (two-tailed)

1 This model has 5 degrees of freedom

Appendix Table C26: Selected Model Fit Indices for the *Member's Patronage Horizon* Confirmatory Factor Analysis Model.

Fit Index	Estimated Model Value	Recommended Value
χ^2_m	19.53[1]	Value heavily influenced by sample size. No general recommendation
Root-Mean-Square Error of Approximation (RMSEA)	0.071[2]	0.05 or less = close fit 0.05 ≤ value ≤ 0.08 = good fit Value ≥ 0.10 poor fit
Akaike Information Criterion (AIC)	49.53	Used to rank nested models with same structure. Smaller values indicate better fit.
Normed Fit Index (NFI)	0.969	0.90 or greater = good fit
Comparative Fit Index (CFI)	0.976	0.90 or greater = good fit
Tucker-Lewis Index (TLI)	0.929	0.95 or greater = superior fit

1 This model has 5 degrees of freedom. The *p* value was less than 0.001 so H_o is not rejected.
2 90 % confidence interval = 0.040 to 0.106

Appendix Table C27: Summary Statistics for Survey Questions Used as Manifest Indicator Variables for the *Perception of Member Interdependence* Latent Variable.

Variable[1]	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5	Missing	Mean	Variance
Q9d	5	22	159	277	97	15	3.78	0.65
Q9e	6	14	196	272	75	12	3.70	0.59
Q9f	89	266	187	8	10	15	2.26	0.65

1 The items in Questions 9 were ordered alphabetically from top to bottom.

Appendix Table C28: Pearson Correlation Coefficients for Survey Questions Used as Manifest Indicator Variables for the *Perception of Member Interdependence* Latent Variable.

Variable [1]	Q9d	Q9e	Q9f
Q9d	1.00	0.468	-0.288
Q9e	0.468	1.00	-0.551
Q9f	-0.288	-0.551	1.00

1 Coefficients estimated using pairwise deletion for missing data

Appendix Table C29: Unstandardized Factor Loadings, Standardized Factor Loadings, Estimated Standard Errors, Critical Ratios, *P* Values and Squared Multiple Correlations for the *Perception of Member Interdependence* Confirmatory Factor Analysis Model.

Manifest Variable	Untandardized Factor Loadings	Standardized Factor Loading	Estimated Standard Error	*z* Critical Ratio[1]	*P* Value	Squared Multiple Correlation
Q9d	0.398	0.494	0.039	10.299	***	0.244
Q9e	0.729	0.950	0.046	15.675	***	0.902
Q9f	-0.467	-0.581	0.040	-11.638	***	0.338

*** Indicates a *P* value of less than 0.001 (two-tailed)

1 This model has 0 degrees of freedom and is a just identified model.

Appendix Table C30: Selected Model Fit Indices for the *Perception of Member Interdependence* Confirmatory Factor Analysis Model.

Fit Index	Estimated Model Value	Recommended Value
χ^2_m	0.00 [1]	Value heavily influenced by sample size. No general recommendation
Root-Mean-Square Error of Approximation (RMSEA)	0.312 [2]	0.05 or less = close fit 0.05 ≤ value ≤ 0.08 = good fit Value ≥ 0.10 poor fit
Akaike Information Criterion (AIC)	18.00	Used to rank nested models with same structure. Smaller values indicate better fit.
Normed Fit Index (NFI)	1.000	0.90 or greater = good fit
Comparative Fit Index (CFI)	1.000	0.90 or greater = good fit
Tucker-Lewis Index (TLI)	N.A.	0.95 or greater = superior fit

1 This model has 0 degrees of freedom and is a just identified model.

2 90 % confidence interval = 0.284 to 0.341

Appendix Table C31: Summary Statistics for Survey Questions Used as Direct Manifest Indicator Variables.

Variable [1]	No = 0	Yes = 1	Missing	Mean	Variance
Q22a	268	273	34	0.50	0.25
Q22b	425	116	34	0.21	0.17
Q22c	346	195	34	0.36	0.23
Q22d	403	138	34	0.26	0.19
Q22e	495	46	34	0.09	0.08
Q22f	322	219	34	0.40	0.24
Q22g	529	12	34	0.02	0.02
Q22h	510	31	34	0.06	0.05

1 The items in Questions 22 were ordered alphabetically from top to bottom.

Appendix Table C32: Summary Statistics for Survey Questions Used as Direct Manifest Indicator Variables .

Variable[1]	Less Than $9,999	$10,000 to $99,999	$100,000 to $249,999	$250,000 to $499,999	$500,000 to $749,999	More Than $750,000	Missing	Mean	Variance
Q25	56	178	112	86	26	62	55	3.07	2.21
Q26	8	21	77	105	287	N.A.	77	4.29	0.96

APPENDIX D

Summary Statistics for Structural Models

Used to Test Research Hypothesis 2

Appendix Table D1: Unstandardized Factor Loadings, Standardized Factor Loadings, Estimated Standard Errors, Critical Ratios and *P* Values for the *Member Free Riding, Cooperative By-Laws and Policies* and Provision of Important Member Benefits Structural Model.

Endogenous Variable	Exogenous Variable	Un-Std. Loadings	Std. Loading	Standard Error	Critical Ratio[1]	*P* Value
Free Riding	CBP	0.300	0.467	0.043	6.937	***
Free Riding	Imp. Sell	-0.083	-0.129	0.047	-1.759	0.079
Free Riding	Prov. Sell	0.244	0.379	0.046	5.290	***
Free Riding	Buyer Ben.	0.062	0.096	0.040	1.555	0.120
Free Riding	Borr. Ben.	-0.068	-0.105	0.041	-1.658	0.097
Free Riding	Vol. Ben.	-0.054	-0.084	0.044	-1.232	0.218
Q9a	Free Riding	0.828	0.632	0.085	9.784	***
Q9b	Free Riding	0.466	0.371	0.071	6.559	***
Q9c	Free Riding	-0.313	-0.191	0.084	-3.739	***
Q9g	Free Riding	0.814	0.592	0.086	9.450	***
Q9i	Free Riding	1.000	0.591	N.A.	N.A.	N.A.
Q9k	Free Riding	0.934	0.541	0.081	11.492	***
Q18	Free Riding	-0.308	-0.448	0.040	-7.674	***
Q17a	CBP	0.757	0.541	0.059	12.863	***
Q17b	CBP	0.830	0.544	0.064	12.898	***
Q17c	CBP	1.264	0.735	0.067	18.858	***
Q17d	CBP	1.253	0.756	0.064	19.718	***
Q17e	CBP	1.277	0.823	0.057	22.376	***
Q17f	CBP	1.270	0.797	0.059	21.391	***
Q17g	CBP	1.231	0.757	0.062	19.803	***
Q17h	CBP	1.184	0.730	0.063	18.784	***
Q17i	CBP	0.805	0.521	0.066	12.270	***
Q17j	CBP	0.384	0.244	0.073	5.288	***
Q17k	CBP	0.425	0.312	0.062	6.820	***
Q17l	CBP	1.023	0.670	0.062	16.521	***
Q17m	CBP	1.069	0.651	0.067	15.941	***
Q10a1	Imp. Sell	1.098	0.698	0.064	17.126	***
Q10b1	Imp. Sell	1.090	0.683	0.066	16.603	***
Q10c1	Imp. Sell	1.132	0.732	0.062	18.232	***
Q10d1	Imp. Sell	1.141	0.731	0.063	18.213	***
Q10e1	Imp. Sell	0.881	0.504	0.077	11.444	***
Q10h1	Imp. Sell	0.953	0.606	0.067	14.243	***
Q10k1	Imp. Sell	1.073	0.541	0.087	12.336	***
Q11a1	Imp. Sell	1.037	0.717	0.059	17.611	***
Q11d1	Imp. Sell	0.928	0.697	0.054	17.039	***
Q11g1	Imp. Sell	1.063	0.624	0.072	14.668	***
Q10a2	Prov. Sell	1.107	0.779	0.053	21.001	***

Appendix Table D1: (cont.) Unstandardized Factor Loadings, Standardized Factor Loadings, Estimated Standard Errors, Critical Ratios and *P* Values for the *Member Free Riding, Cooperative By-Laws and Policies* and Provision of Important Member Benefits Structural Model.

Endogenous Variable	Exogenous Variable	Un-Std. Loadings	Std. Loading	Standard Error	Critical Ratio[1]	*P* Value
Q10b2	Prov. Sell	1.163	0.800	0.054	21.692	***
Q10c2	Prov. Sell	1.254	0.886	0.049	25.582	***
Q10d2	Prov. Sell	1.236	0.877	0.049	25.108	***
Q10e2	Prov. Sell	0.860	0.509	0.071	12.076	***
Q10h2	Prov. Sell	0.848	0.581	0.060	14.118	***
Q10k2	Prov. Sell	0.857	0.505	0.073	11.778	***
Q11a2	Prov. Sell	0.722	0.573	0.052	13.801	***
Q11d2	Prov. Sell	0.705	0.538	0.055	12.891	***
Q11g2	Prov. Sell	0.763	0.521	0.063	12.194	***
Q10f1	Buyer Ben.	1.326	0.664	0.079	16.789	***
Q10f2	Buyer Ben.	1.175	0.640	0.073	16.058	***
Q10i1	Buyer Ben.	1.329	0.670	0.079	16.892	***
Q10i2	Buyer Ben.	1.147	0.656	0.070	16.470	***
Q11b1	Buyer Ben.	1.743	0.867	0.070	24.647	***
Q11b2	Buyer Ben.	1.430	0.850	0.060	23.805	***
Q11e1	Buyer Ben.	1.841	0.869	0.074	24.759	***
Q11e2	Buyer Ben.	1.631	0.870	0.066	24.826	***
Q11h1	Buyer Ben.	1.769	0.853	0.074	24.005	***
Q11h2	Buyer Ben.	1.464	0.845	0.062	23.599	***
Q10g1	Borr. Ben.	1.465	0.873	0.059	25.030	***
Q10g2	Borr. Ben.	1.338	0.856	0.055	24.143	***
Q10j1	Borr. Ben.	1.493	0.856	0.062	24.098	***
Q10j2	Borr. Ben.	1.325	0.866	0.054	24.597	***
Q11c1	Borr. Ben.	1.445	0.805	0.066	21.852	***
Q11c2	Borr. Ben.	1.212	0.807	0.055	21.898	***
Q11f1	Borr. Ben.	1.498	0.873	0.060	24.980	***
Q11f2	Borr. Ben.	1.346	0.866	0.055	24.608	***
Q11i1	Borr. Ben.	1.488	0.736	0.078	19.190	***
Q11i2	Borr. Ben.	1.260	0.770	0.062	20.433	***
Q10l1	Vol. Ben.	1.361	0.739	0.073	18.540	***
Q10l2	Vol. Ben.	1.230	0.740	0.066	18.750	***
Q10m1	Vol. Ben.	1.597	0.829	0.073	21.943	***
Q10m2	Vol. Ben.	1.441	0.856	0.062	23.106	***

*** Indicates a *P* value of less than 0.001 (two-tailed)

1 This model has 1914 degrees of freedom

Appendix Table D2: Correlations for the *Member Free Riding*, *Cooperative By-Laws and Policies* and Provision of Important Member Benefits Structural Model.

Variables		Correlation Estimate	Standard Error	Critical Ratio [1]	*P* Value
Buyer Ben.	Borr. Ben.	0.539	0.033	16.228	***
Imp. Sell	Prov. Sell	0.587	0.034	17.130	***
Imp. Sell	CBP	0.426	0.042	10.084	***
Buyer Ben.	Vol. Ben.	0.467	0.038	12.134	***
Borr. Ben.	Vol. Ben.	0.483	0.038	12.778	***
Imp. Sell	Vol. Ben.	0.506	0.040	12.746	***
Prov. Sell	Vol. Ben.	0.471	0.039	12.105	***
CBP	Vol. Ben.	0.316	0.045	7.022	***
CBP	Prov. Sell	0.426	0.040	10.651	***
Prov. Sell	Borr. Ben.	0.351	0.041	8.557	***
Imp. Sell	Borr. Ben.	0.303	0.045	6.796	***
Prov. Sell	Buyer Ben.	0.398	0.039	10.074	***
Imp. Sell	Buyer Ben.	0.386	0.042	9.172	***
CBP	Borr. Ben.	0.385	0.041	9.399	***
CBP	Buyer Ben.	0.299	0.043	6.881	***
e9a	e9b	0.195	0.028	7.069	***
e9i	e9k	0.284	0.048	5.898	***
e17f	e17g	0.813	0.070	11.596	***
e17g	e17h	1.062	0.081	13.054	***
e17f	e17h	0.830	0.072	11.590	***
e10a1	e10b1	0.823	0.082	10.096	***
e10c1	e10d1	0.790	0.075	10.488	***
e17j	e17k	1.061	0.101	10.458	***
e17l	e17m	0.649	0.077	8.428	***
e11i1	e11i2	0.872	0.082	10.619	***
e11c2	e11f2	0.383	0.039	9.835	***
e11c1	e11f1	0.536	0.051	10.420	***
e11f1	e11f2	0.157	0.026	5.998	***
e11c1	e11c2	0.234	0.035	6.764	***
e10i1	e10i2	1.208	0.103	11.714	***
e10f2	e10f1	1.501	0.116	12.935	***
e10f2	e10i2	0.437	0.051	8.539	***

*** Indicates a *P* value of less than 0.001 (two-tailed)

1 This model has 1914 degrees of freedom

Appendix Table D3: Selected Model Fit Indices for *Member Free Riding*, *Cooperative By-Laws and Policies* and Provision of Important Member Benefits Structural Model.

Fit Index	Estimated Model Value	Recommended Value
χ^2_m	9,735.55 [1]	Value heavily influenced by sample size. No general recommendation
Root-Mean-Square Error of Approximation (RMSEA)	0.084[2]	0.05 or less = close fit 0.05 ≤ value ≤ 0.08 = good fit Value ≥ 0.10 poor fit
Akaike Information Criterion (AIC)	10,195.55	Used to rank nested models with same structure. Smaller values indicate better fit.
Normed Fit Index (NFI)	0.686	0.90 or greater = good fit
Comparative Fit Index (CFI)	0.730	0.90 or greater = good fit
Tucker-Lewis Index (TLI)	0.707	0.95 or greater = superior fit

1 This model has 1914 degrees of freedom. The *p* value was less than 0.001 so H_o is not rejected.
2 90 % confidence interval = 0.083 to 0.086

Appendix Table D4: Unstandardized Factor Loadings, Standardized Factor Loadings, Estimated Standard Errors, Critical Ratios, and *P* Values for the *Member Free Riding, Cooperative By-Laws and Policies, Provision of Seller Benefits, Perception of Member Interdependence, Member's Patronage Horizon* latent variable and direct manifest variable Structural Model.

Endogenous Variable	Exogenous Variable	Un-Std. Loadings	Std. Loading	Standard Error	Critical Ratio[1]	*P* Value
Free Riding	CBP	0.129	0.259	0.029	4.502	***
Free Riding	Prov. Sell	0.107	0.215	0.028	3.805	***
Free Riding	Interdep.	0.231	0.463	0.033	7.069	***
Free Riding	Horizon	0.044	0.089	0.024	1.838	0.066
Free Riding	Q22a	0.062	0.062	0.042	1.451	0.147
Free Riding	Q22b	0.034	0028	0.052	0.666	0.505
Free Riding	Q22c	0.047	0.045	0.044	1.064	0.288
Free Riding	Q22d	-0.067	-0.058	0.049	-1.373	0.170
Free Riding	Q22e	0.072	0.040	0.076	0.946	0.344
Free Riding	Q22f	0.110	0.108	0.044	2.519	0.012
Free Riding	Q22g	-0.096	-0.029	0.144	-0.672	0.502
Free Riding	Q22h	0.035	0.016	0.091	0.384	0.701
Free Riding	Q25	-0.005	-0.016	0.014	-0.367	0.714
Free Riding	Q25	0.028	0.056	0.022	1.257	0.209
Q9a	Free Riding	1.174	0.696	0.111	10.547	***
Q9b	Free Riding	0.726	0.448	0.093	7.764	***
Q9c	Free Riding	-0.424	-0.200	0.1.06	-4.000	***
Q9g	Free Riding	1.000	0.565	N.A.	N.A.	N.A.
Q9i	Free Riding	1.196	0.549	0.129	9.257	***
Q9k	Free Riding	1.076	0.484	0.127	8.451	***

Appendix Table D4: (cont.) Unstandardized Factor Loadings, Standardized Factor Loadings, Estimated Standard Errors, Critical Ratios, and *P* Values for the *Member Free Riding, Cooperative By-Laws and Policies, Provision of Seller Benefits, Perception of Member Interdependence, Member's Patronage Horizon* latent variable and direct manifest variable Structural Model.

Endogenous Variable	Exogenous Variable	Un-Std. Loadings	Std. Loading	Standard Error	Critical Ratio[1]	*P* Value
Q18	Free Riding	-0.372	-0.419	0.050	-7.436	***
Q17a	CBP	0.759	0.542	0.059	12.892	***
Q17b	CBP	0.802	0.526	0.065	12.371	***
Q17c	CBP	1.255	0.729	0.067	18.615	***
Q17d	CBP	1.245	0.751	0.064	19.493	***
Q17e	CBP	1.294	0.833	0.057	22.797	***
Q17f	CBP	1.284	0.805	0.059	21.697	***
Q17g	CBP	1.245	0.765	0.062	20.093	***
Q17h	CBP	1.199	0.738	0.063	19.059	***
Q17i	CBP	0.809	0.523	0.066	12.329	***
Q17j	CBP	0.376	0.238	0.073	5.164	***
Q17k	CBP	0.415	0.305	0.062	6.642	***
Q17l	CBP	1.027	0.673	0.062	16.594	***
Q17m	CBP	1.068	0.650	0.067	15.899	***
Q10a2	Prov. Sell	1.015	0.714	0.057	17.907	***
Q10b2	Prov. Sell	1.048	0.721	0.058	18.083	***
Q10c2	Prov. Sell	1.111	0.784	0.055	20.343	***
Q10d2	Prov. Sell	1.073	0.762	0.055	19.467	***
Q10e2	Prov. Sell	0.945	0.559	0.072	13.079	***
Q10h2	Prov. Sell	0.945	0.647	0.060	15.656	***
Q10k2	Prov. Sell	0.896	0.527	0.075	12.012	***
Q11a2	Prov. Sell	0.829	0.658	0.052	15.913	***
Q11d2	Prov. Sell	0.814	0.620	0.055	14.875	***
Q11g2	Prov. Sell	0.885	0.604	0.063	14.120	***
Q5	Horizon	10.687	0.842	0.518	20.618	***
Q6	Horizon	12.322	0.889	0.565	21.825	***
Q7	Horizon	6.340	0.451	0.661	9.599	***
Q22i	Horizon	0.138	0.342	0.018	7.626	***
Q22j	Horizon	0.038	0.148	0.012	3.228	0.001
Q9d	Interdep.	0.514	0.639	0.036	14.387	***
Q9e	Interdep.	0.595	0.775	0.034	17.634	***
Q9f	Interdep.	-0.486	-0.605	0.036	-13.563	***

*** Indicates a *P* value of less than 0.001 (two-tailed)

1 This model has 1063 degrees of freedom

Appendix Table D5: Correlations for the *Member Free Riding, Cooperative By-Laws and Policies, Provision of Seller Benefits, Perception of Member Interdependence, Member's Patronage Horizon* latent variable and direct manifest variable Structural Model.

Variables		Correlation Estimate	Standard Error	Critical Ratio [1]	*P* Value
Interdep.	Horizon	0.270	0.050	5.406	***
Interdep.	CBP	0.317	0.049	6.436	***
Interdep.	Prov. Sell	0.288	0.051	5.686	***
CBP	Prov. Sell	0.453	0.041	11.157	***
Prov. Sell	Horizon	0.040	0.050	0.802	0.423
CBP	Horizon	0.002	0.049	0.049	0.961
e9a	e9b	0.142	0.026	5.499	***
e9i	e9k	0.347	0.047	7.363	***
e17f	e17g	0.781	0.069	11.361	***
e17g	e17h	1.031	0.080	12.885	***
e17f	e17h	0.800	0.070	11.368	***
e10a2	e10b2	0.628	0.064	9.875	***
e10c2	e10d2	0.539	0.057	9.425	***
e17j	e17k	1.068	0.102	10.489	***
e17l	e17m	0.648	0.077	8.419	***

*** Indicates a *P* value of less than 0.001 (two-tailed)

1 This model has 1061 degrees of freedom

Appendix Table D6: Selected Model Fit Indices for the *Member Free Riding, Cooperative By-Laws and Policies, Provision of Seller Benefits, Perception of Member Interdependence, Member's Patronage Horizon* latent variable and direct manifest variable Structural Model.

Fit Index	Estimated Model Value	Recommended Value
χ^2_m	3220.66 [1]	Value heavily influenced by sample size. No general recommendation
Root-Mean-Square Error of Approximation (RMSEA)	0.060[2]	0.05 or less = close fit 0.05 ≤ value ≤ 0.08 = good fit Value ≥ 0.10 poor fit
Akaike Information Criterion (AIC)	3546.66	Used to rank nested models with same structure. Smaller values indicate better fit.
Normed Fit Index (NFI)	0.739	0.90 or greater = good fit
Comparative Fit Index (CFI)	0.807	0.90 or greater = good fit
Tucker-Lewis Index (TLI)	0.786	0.95 or greater = superior fit

1 This model has 1061 degrees of freedom. The *p* value was less than 0.001 so H_o is not rejected.

2 90 % confidence interval = 0.057 to 0.062

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