A STUDY OF THE PROPERTY RIGHTS CONSTRAINTS IN US AGRICULTURAL COOPERATIVES: THEORY AND EVIDENCE

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

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a candidate for the degree of Doctor of Philosophy

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To Professor Costa Papageorgiou

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ABSTRACT

This research addresses the issue of efficient user-owned and controlled organizational design. Using agricultural cooperatives as an example set of user-owned and controlled institutional arrangements, the economic issue examined is the degree of residual rights of control and residual claims alignment. Leading organizational scholars (e.g., Milgrom and Roberts 1992, Hart 1995, and Hart and Moore 1998) suggest that, in the case of a firm, it is advantageous to have as many decision rights as possible vested with the party receiving the residual returns. This is because in the process of maximizing its own individual returns, that party will also generally be led to maximize organizational efficiency. Until now, scholarly work has concentrated on investor-oriented forms of business organization.

This study explores the applicability of the residual claims-residual control rights-argument to alternative business forms. Specifically, this dissertation inspects the strength of the residual claims-residual control rights-criterion in examining user-owned firms. Even more specifically, this research applies the Coasian "nexus of contracts" definition of efficiency to user-owned agricultural cooperatives in US. From a neo-institutional point of view, this study is concerned with the design of a producer-driven, collective action, business organization—an *ex ante* contract which assigns residual

rights of control and residual claimant rights in an organizational efficiency-maximizing way.

In designing an efficiency-maximizing institutional arrangement for a producer-owned and controlled business firm, several important questions must be addressed. Some of these questions include; what are the origins of the current property right structure in US producer-owned business firms in agriculture? What are the efficiency implications of this structure? How could the inefficiencies characterizing this property right structure be ameliorated? What might be the characteristics of an efficiently designed producer-owned alternative ownership structure? Which ownership structure is successful in aligning residual rights of control and residual claims?

This research provides answers to these questions by developing a neo-institutional theoretical framework for analyzing and comparing alternative firm ownership structures. This neo-institutional theoretical framework is particularly applicable to studying incentives facing the residual claimants of a firm and their investment behavior under various property right assignments. The impact of the property rights structure on investment incentives facing cooperative stakeholders, and particularly, members and management, has been crystallized into a set of three problems, facing traditional US agricultural cooperatives. These are the free rider, the horizon, and the portfolio constraints.

The main hypothesis of this research is that the property rights structure observed in cooperative firms significantly affects the incentives of members to invest in their organizations. To test this hypothesis, a structural equation model with latent variables is developed and tested against data from a national survey of US agricultural cooperatives.

The information provided by these data enables a detailed description, documentation, and summarization of the ownership structure of both traditional and new generation forms of collective action in US agriculture. Subsequently, the most statistically significant property right characteristics for providing investment incentives to the stakeholders of producer-owned firms are identified ad empirically verified. The obtained results suggest that the property rights structure of US agricultural cooperatives significantly affect members' incentive to invest in their organizations. Clearly defined property rights are a prerequisite for attracting members' equity capital to US agricultural cooperatives. The results of this study have serious implications for cooperative organizational design and strategic management, as well as for public policy.

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CHAPTER ONE

INTRODUCTION TO STUDY

> "The structure of the property rights in a cooperative ... strongly suggests that such organizations are going to face certain intractable problems that will render their organizational form inefficient." (Porter and Scully 1987, p. 495)

This research addresses the issue of efficient user-owned and controlled organizational design. Using agricultural cooperatives as an example set of user-owned and controlled institutional arrangements, the economic issue examined is the degree of residual rights of control and residual claims[1] alignment. Leading organizational scholars (e.g., Milgrom and Roberts 1992, Hart 1995, and Hart and Moore 1998) suggest an advantage, in the case of a firm, of having as many decision rights as possible vested with the party receiving the residual returns because in the process of maximizing its own individual returns, that party will also generally be led to maximize organizational efficiency. Until now, scholarly work has concentrated on investor-oriented forms of business organization.

This study attempts to explore the applicability of the residual claims-residual control rights-argument to alternative business forms. The strength of the residual claims-residual control rights-criterion related to user-owned firms is examined by

[1] Residual right of control is the right to make any decision concerning an asset's use that is not explicitly assigned by law or contract to another party. Residual claimant right is the right to receive the residual return from an asset, where the residual return refers to the income from an asset or business that remains after all fixed obligations have been met.

applying the Coasian "nexus of contracts" definition of efficiency to user-owned agricultural cooperatives in US. From a neo-institutional point of view, this study is concerned with the design of a producer-driven, collective action, business organization—an *ex ante* contract which assigns residual rights of control and residual claimant rights in an organizational efficiency-maximizing way.

In designing such an efficiency-maximizing institutional arrangement, several important questions must be addressed. What are the origins of the current property right structure in US producer-owned business firms in agriculture? What are the efficiency implications of this structure? How could the inefficiencies characterizing this property right structure be ameliorated? What might be the characteristics of an efficiently designed producer-owned alternative ownership structure? Which ownership structure is successful in aligning residual rights of control and residual claims?

Answers to these questions are sought by developing a neo-institutional theoretical framework for analyzing and comparing alternative firm ownership structures. This framework is particularly applicable for studying incentives facing the residual claimants of a firm and their investment behavior under various property right assignments with empirical tests of the hypotheses derived from the theoretical framework.

Origins of the Property Right Structure in Producer-Owned Firms in Agriculture

The property right structure used by most US producer-owned and controlled firms in agriculture has its origins in a set of business practices (cooperative principles) introduced by consumer collective action in England during the mid-1800s. By the 1920's, these rules and norms were institutionalized and consolidated into the three hard-core principles: democratic control, service at cost and limited return on equity.

By the mid-1980's, a further refinement of the cooperative principles was formalized by the US Senate-requested study coordinated by the US Department of Agriculture's Agricultural Cooperative Services (USDA-ACS[2]). That inquiry defined a cooperative as a user-owned, user-controlled, and user benefited agricultural producer organization. More explicitly:

1. The farmer stockholding *owners* are the major *users* of the cooperative.
2. The *benefits* received by the farmer-owner stockholder who contributed equity capital to a cooperative are tied to the concept of *use* of the cooperative in the form of patronage.
3. The *control* of the cooperative by the owner stockholder *user* must be structured democratically, i.e. voting power is not proportional to equity investment although it may be in certain situations structured in proportion to *usage*.

These principles ultimately define the property rights of the user member in the collectively owned organization in the US. These property rights establish incentives and

[2] Currently named USDA/Rural Business-Cooperative Services

disincentives as to the investment, patronage and control behavior of the user-member, and in some cases are quite distinct from those facing the investor-owners of non-cooperative firms. Such differences present governance, management, and financing challenges to cooperative leaders (Cook 1993).

US agricultural cooperatives can be generically taxonomized according to the property right structure they adopt. Traditional producer-owned and controlled organizations with open membership have risk capital generated mostly by retained earnings from member patronage, and illiquid equity ownership rights. New generation cooperatives are characterized by the existence of a secondary market for their residual claims, patronage and residual claimant status restrictions, and enforcement of member pre-commitment mechanisms. These alternative property right structures have significant efficiency implications for collectively organized business enterprises.

Producer-owned and controlled business firms, a form of collective action, have played important coordinating roles in many food and agricultural markets worldwide in the twentieth century[3]. In the US, their market shares have been increasing in a constant rate for the past half-century (Table 1.1).

[3] A detailed historical analysis of the role of agricultural cooperatives in the evolution of the US food system, and the legal-institutional environment in which cooperatives have been nurtured and fostered can be found in Knapp (1969) and Suhler and Cook (1993).

Table1.1. U.S. Farmer Cooperatives Share of Farm Marketings and Farm Production Expenditures, 1950-1996, in Percentages, for Selected Years

	1950	1960	1970	1984	1988	1990	1992	1993	1996
Percent of Cash Receipts Of Farm Marketings	17	24	26	30	25	27	27	30	34
Percent of Farm Production Expenditures	14	15	16	28	25	27	29	28	28

Source: USDA-ACS, Farmer Cooperatives, and Cooperative Historical Statistics.

During this period, the three cooperative principles (the user-owned, user-controlled, and user-benefited principles) were institutionalized and used to distinguish between cooperative and non-cooperative business firms. Simultaneously, a number of federal and state cooperative regulations[4] were introduced, requiring a cooperative "operate on a cooperative basis," been interpreted to mean, "as a user-owned, user-controlled and user-benefited firm." The Internal Revenue Service, federal courts, and state courts viewed "cooperative principles" as defining the essence of a cooperative. As a result, several organizational inefficiencies resulting from these cooperative principles were further institutionalized and even thought to be a natural characteristic of all user-owned organizations.

[4] Subchapter T of the Internal Revenue Service (IRS), the federal tax provision of Section 521, the Capper-Volstead Act for antitrust exemption, the Security Act of 1933, and the state incorporation, antitrust, and security statutes.

Although the most successful producer-owned business firms in the US agriculture corrected market failures for their members during this period and attempted to modify their organizational structure to enhance agribusiness performance, they were still faced with a unique set of internal incentive problems. These problems generated by a set of vaguely defined "user versus owner" set of property rights (VDPR), created disincentives for cooperative members to invest in their organizations.

Most US producer-owned firms realized the need for cost minimization and increased investment in capital-intensive industries during the 1980's farm crisis, a period of dramatic change in agriculture and in the agri-food system. As globalization, industrialization and privatization increased, property rights—ownership structure—problems (VDPR) faced by producer cooperatives intensified adding, either directly or indirectly, to the difficulty cooperatives have in generating risk capital. These decision-makers came to realize that capital acquisition and a flexible capital structure are important determinants of the ability of collectively owned firms to grow and compete with other types of business organizations, such as investor-oriented firms (Staatz 1987d; Vitaliano 1985). Since the early 1990s, the leaders of collectively organized producers in North America became extremely active in adopting innovative organizational structures to improve their equity and debt capital structures.

As cooperative leaders were coming to realize the implications of alternative ownership structures for organizational efficiency, scholars were puzzling over a series of

critical issues that could not be addressed by standard, neoclassical, economic theory. Condon (1990, p. 9) noted:

> "Current models of cooperative behavior are particularly lacking in treatment of the institutional economic factors that distinguish cooperatives from the other forms of organizing economic activity. As a result, there exists little or no theoretical treatment of cooperatives in a dynamic context, because analysts do not yet recognize that cooperative ownership and organization may have a direct impact on these firms over time in such areas as the incentive structure for attracting member-patron investment capital."

In their search for new theories and tools to address issues related to the incentive structure of producer-owned firms, theorists have and are developing theoretical concepts in, (a) neo-institutional economics, (b) game theory, and (3) strategic management theory. Significant work by Staatz (1984, 1987), Vitaliano (1978, 1983, 1985), Condon (1987, 1990) Sexton (1986), Porter and Scully (1988), Cook (1995), and Fulton (1995) emerged. Vitaliano, Condon, and Cook, particularly, incorporated recent developments in the economics of property rights (Grossman and Hart 1986; Hart and Moore 1990; Milgrom and Roberts 1992; Hart 1995; and Barzel 1989, 1997) to address the aforementioned vaguely defined property right constraints facing agricultural cooperatives.

The property rights approach identifies the most important characteristics of the property right structure in any firm as: (1) the assignment of residual claims and the alignment of residual claimant and residual control rights, (2) the degree of transferability of residual claims, (3) the degree of redeemability of residual claims, and (4) the time horizon of residual claims. Cooperative principles and regulations create and promote a

property rights structure characterized by non-transferable, non-redeemable and limited time horizon residual claims that results in misalignment of residual rights of control and residual claimant rights. Such a structure creates an organizational environment, which encourages inefficient decision-making.

The traditional cooperative property right structure gives rise to the five vaguely defined property rights constraints (VDPR), which act as endogenous barriers prohibiting cooperatives from achieving maximum organizational efficiency. These constraints are identified in theoretical contributions by Vitaliano, Condon, and Cook, as: the free rider, the horizon, the portfolio, the control, and the influence costs constraints. These five in turn [5] can be usefully divided into two generic sets: (1) collective decision-making constraints and (2) investment constraints. Collective decision-making constraints (the control and influence costs constraints), influence the level of efficiency characterizing collective decision-making in cooperatives. Investment constraints (the free rider, horizon, and portfolio constraints affect the incentives of cooperative members to invest in their organizations. This study focuses, exclusively, on the three investment property right constraints.

Theoretical cooperative research during the 1980s and 1990s was very productive. Unfortunately, this work was not accompanied by supporting empirical tests of the very interesting hypotheses that this work generated. In 1987, Staatz suggested that:

[5] The terms "problems" and "constraints" are used interchangeably to refer to the five vaguely defined property rights constraints.

> "...currently, the most promising area for researchers may be to begin testing the hypotheses flowing from recent theoretical work. For example, what evidence is there of the 'horizon problem' predicted by Condon and Vitaliano..."

Most authors discussing the implications of the five vaguely defined property rights constraints have arrived at the same conclusion (e.g., Condon 1990). This study seeks to add to the current state of knowledge through detailed theoretical and empirical investigation of the aforementioned hypotheses.

Objectives and Procedures

The development of an integrated, neo-institutional theoretical framework facilitates the conceptualization of organizational-efficiency implications of alternative property right structures in producer-owned firms. Of particular interest are the changes in the incentives of the customer-owners to invest in their organizations in relationship to alternative property right assignments. In addition, a number of previously developed conceptual insights are aggregated into a unified economic theory of the cooperative firm, and new paradigms are posited and formally asserted. These paradigms specifically elucidate the efficiency implications of alternative firm ownership structures in collective action. The proposed neo-institutional framework is also helpful in identifying and exposing the causal factors of severe investment disincentives faced by members of traditional collective action firms and suggestions are made for ameliorating the investment constraints.

The second part of the study is devoted to the empirical testing of the generated hypotheses. A structural equation model with latent variables is developed and tested against data from a national survey of US agricultural cooperatives. These data provide a detailed description, documentation, and summarization of the ownership structure of both traditional and new generation forms of collective action in US agriculture. Subsequently, the property right characteristics that provide investment incentives to the stakeholders of producer-owned firms can be identified and empirically verified. Finally, implications for cooperative leaders and public policy-makers will be summarized. In total, this study is intended to be a contribution toward the establishment of a comprehensive and empirically tested economic theory of the cooperative firm.

CHAPTER TWO

THE PROPERTY RIGHTS APPROACH:

THE THEORY OF THE FIRM AND ITS APPLICATIONS

During the last twenty years, cooperative scholars have been utilizing developments in the theory of the firm to better understand the strengths and weaknesses of the cooperative business organization. The five vaguely defined property rights constraints analyzed in this research were identified by incorporating assumptions regarding property rights structures into the theory of the cooperative firm.

The basic ideas behind this approach to the study of the cooperative firm come from the theory of economic property rights, particularly the property rights approach to the theory of the firm. In order to understand and appreciate the insights gained through the property rights approach, one should contrast and compare it to other economic theories of the firm. In this chapter, the property rights approach is introduced and compared to other existing theories of the firm to facilitate the understanding of the theoretical framework used to study the vaguely defined property right constraints. Furthermore, the applications of the property rights approach with respect to the cooperative firm are discussed and the current major economic theories of the firm are introduced.

Major Existing Economic Theories of the Firm

In the last quarter of this century, the two most prominent schools of economic thought addressing major issues regarding the organization of the business firm, are neoclassical economics (NC), and neo-institutional economics (NIE). While the assumptions of these theories differ, neo-institutional theories of the firm can be viewed mainly as extensions of the standard neoclassical model. These extensions were necessary for better understanding of observed intra-firm phenomena not addressed under the more simplistic assumptions of NC.

The Neoclassical Theory of the Firm

Neoclassical economic theory views the firm mainly in technological terms. A single-product firm is represented by a production function which specifies the output level that is obtained when given levels of inputs are chosen. It assumes the firm to be run by a selfless manager, who chooses input and output levels to maximize profits or, equivalently, to minimize costs.

In the neoclassical theory of the firm, the basic unit of analysis is the "firm," which is primarily viewed as a "black box"; internal affairs or organization do not play any role. Market prices act as both coordination and motivation mechanisms, with no need to design incentive mechanisms; prices suffice.

The underlying behavioral assumptions of the neoclassical model include: 1) people are selfless, 2) consumers are utility maximizers and firms are profit maximizers,

and 3) economic actors are risk averse. Furthermore, several organizational assumptions are either explicitly or implicitly incorporated in the model. (1) information asymmetries are assumed away and economic actors possess all relevant information when making decisions, (2) effectiveness is measured by a firm's ability to maximize its profits, (3) it is assumed that no conflict exists between individuals at any level, and (4) firms and individuals face no contracting problems, since all exchanges take place in the market, and information is free.

The neoclassical economics approach, which relies primarily on economics and mathematics, is characterized by two major strengths. First, it stresses the role of technology in general, and returns to scale in particular, as important determinants of the size of firms. Second, it has been very useful in analyzing how the firm's optimal production choice varies with input and output prices, in understanding the aggregate behavior of an industry, and in studying the consequences of strategic interaction between firms once the assumption of perfect competition has been dropped (Hart 1995).

However, neoclassical theory embodies a number of weaknesses, once focus is shifted from the price system to the firm. First, it completely ignores problems within the firm and thus it has nothing to say about the internal organization of firms. Hierarchical structure, delegation of decisions, authority distribution, asset ownership, and other similarly important issues cannot be dealt with within the neoclassical framework (Demsetz 1997).

New[6] Institutional Economics (NIE)

As Oliver Williamson (1985) has noted, the term New Institutional Economics presumes that there was a predecessor. Indeed, "Institutional Economics" –introduced by W. Hamilton in 1919—developed during the first four decades of this century based on the writings of Veblen, Commons, and Mitchell, who introduced the notion that institutions matter. Commons, for example, defined institutions as "collective action in control, liberation and expansion of individual action" and used the *transaction* as the unit of analysis of people and firms' economic actions.

However, institutional economics offered no single "institutional" theoretical framework. Its lack of a theoretical framework and attention given to methodological criticism of neoclassical economics prevented its development. In spite of its limitations, institutional economics advanced a rich research agenda and also contained the seeds of a theory.

The focus on problems and puzzles rather than methodology made the transition between old and new institutional economics possible. The major contributors to this transition were Armen Alchian (1961), Kenneth Arrow (1969; 1971; 1974), and Alfred Chandler JR. (1962), Ronald Coase (1937; 1960; 1972), Friedrich Hayek (1945), Herbert Simon (1947; 1957), and Williamson (1963, 1975, 1985, 1996).

[6] The two terms (Neo-institutional and New Institutional Economics) are used in this research interchangeably, in agreement with the use of the terms by most scholars. Initially, however, they were used to identify two different schools of thought; Neo-institutional economics maintains the neoclassical framework, and adds to it institutional constraints, while new institutional economics rejects the neoclassical model altogether.

Inherent in much of the work in this area is the fundamental premise that institutions matter[7], that the exchange of goods and services in free markets is not free, and that these two simple observations have implications in understanding the incentives and constraints of economic decision makers (Williamson 1991). In contrast to neoclassical economics, NIE does not treat the firm as a "black box"; instead, it recognizes that behavioral assumptions and contracts between firms, individuals, and firms and individuals, are essential elements of an economic theory of organization.

The three interdisciplinary legs of NIE are law (especially contract law), economics, and organization theory (Williamson 1996). However, the contribution of other disciplines from the social sciences, such as sociology and political science, is constantly increasing and is expected to increase even more. Although NIE has offered new insights and it applies to various situations much remains to be done. Both additional theoretical work and empirical tests of the hypotheses are needed.

Neo-Institutional Economics has two branches; transaction costs and incentive alignment, which can further be divided into the Agency Theory and Property Rights approaches.

Transaction Cost Economics

Transaction cost economics (TCE) is the institutional approach to the study of economic organization in which the transaction is the basic unit of analysis. It involves aspects of

[7] Institutions are defined in this context as the rules and norms of behavior.

economics, law, and organization theory. Any relation that can be described as a contracting problem can be analyzed in transaction cost economics terms. Although Commons first proposed the transaction as the basic unit of analysis, Coase (1937), Oliver Williamson (1975; 1985, 1991) and Klein et al. (1979) made the most important advances in the economic theory of transactions.

Several features distinguish transaction cost economics from other approaches to the study of economic organization characterize. TCE: (1) is more microanalytic, (2) is more self-conscious about its behavioral assumptions, (3) introduces and develops the importance of asset specificity, (4) relies more on comparative institutional analysis, (5) regards the firm as a governance structure rather than as a production function, and (6) places greater weight on the *ex post* institutions of contract, with special emphasis on private ordering--as compared with court ordering (Williamson 1985).

In the literature, transaction costs of both *ex ante* and *ex post* kinds are distinguished. The *ex ante* costs are those incurred in drafting and negotiating agreements. They vary with the design of the good or service to be produced. The *ex post* costs include the setup and running costs of the governance structure to which monitoring is assigned and to which disputes are referred and settled; the maladaptation costs that are incurred for failure to restore positions on the shifting contract curve; the haggling costs that attend adjustments (or the lack thereof); and the bonding costs of effecting secure commitments (Williamson 1985).

The basic strategy followed in transaction cost literature for deriving refutable implications is this: transactions, which differ in their attributes, are assigned to

governance structures, which differ in their organizational goals and competencies, so as to effect a discriminating (mainly transaction cost economizing) match (Williamson 1985, 1996).

The transaction attributes that play the most important role in TCE analysis are five (Milgrom and Roberts 1992):

1. the specificity of the investments required to conduct the transaction,
2. the frequency with which similar transactions occur and the duration or period of time over which they are repeated,
3. the complexity of the transaction and the uncertainty about what performance will be required,
4. the difficulty of measuring performance in the transaction, and
5. the connectedness of the transaction to other transactions involving other people.

TCE makes reference to three behavioral assumptions. The first maintains that human agents are intendedly rational but only limited so (bounded rationality). The second holds that human agents will not reliably self-enforce promises but will defect from the letter and the spirit of an agreement when it suits their purposes (opportunism). The third behavioral assumption is risk neutrality.

Previously, TCE analysis was used mainly in studying vertical integration, long term contracting, and other similar organizational issues. Many of these empirical studies supported the TCE theory particularly in the following categories (Shelanski & Klein 1995):

1. Vertical integration

2. "Hybrid" contracting modes
3. Long-term commercial contracts
4. Informal agreements
5. Franchise contracting

The TCE approach while appealing and applicable to many situations in agriculture and agribusiness, has shortcomings. It tends to take cost structures as given, pays little attention to the ability of different organizational forms to change the distribution of property rights and to the definition of "efficiency" (Bromley 1991). Three additional problems can also be identified. First, we cannot always assume that the total costs of an economic activity can be expressed as the sum of production costs and transaction costs; second, we cannot always assume that efficient institutions minimize transaction costs and that they do not use some other criterion for achieving efficiency (Milgrom & Roberts 1992); third, the empirical testing of transaction cost hypotheses has proved to be somewhat problematic. The proxy variables used for the measurement of unobserved variables, are criticized (e.g., Barzel 1997) as being further removed from the desired variables and leading to unreliable results.

Agency Theory

Agency theory directed at the universal agency relationship in which one party (the principal) delegates work to another (the agent), who performs that work, it attempts to describe this relationship using the metaphor of a contract (Jensen & Meckling 1976).

During the 1960s and early 1970s, economists described the risk-sharing problem as one that arises when cooperating parties have different attitudes toward risk (e.g., Arrow 1971). Adding the so-called agency problem enriched this risk-sharing literature.

Agency theory attempts to resolve two common problems in the principal-agent relationship. The first arises when (a) the desires or goals of the principal and the agent conflict and (b) it is difficult or expensive for the principal to verify what the agent is actually doing. The second concerns the problem of risk sharing, which arises when the principal and the agent have different attitudes toward risk.

The key idea in agency theory analysis is that principal-agent relationships reflect an efficient flow of information and risk-bearing costs, with the unit of analysis the contract between principal and agent. Explicitly or implicitly, agent theorists make three types of assumptions: human (self-interest, bounded rationality, and risk-aversion), organizational (partial goal conflict among participants, efficiency as the effectiveness criterion, information asymmetry between principal and agent), and informational (information as a purchasable commodity).

The major problems addressed by this approach are those of moral hazard and adverse selection in the principal-agent relationship, as well as the problem of risk sharing. The area in which agency theory has proved useful is mainly the study of relationships in which the principal and agent have some differing goals (e.g., compensation, regulation, leadership, impression management, vertical integration, transfer pricing, etc.)

Two streams of thought have developed in agency theory; the positivist and principal-agent approaches (Eisenhardt 1988). Positivist researchers have focused on identifying situations in which the principal and agent are likely to have conflicting goals and then describing the governance mechanisms that limit the agent's self-serving behavior. They almost exclusively focused on the special case of the principal-agent relationship between owners and managers of large, public corporations (Berle & Gardiner 1932). Three influential articles explored the structure of the corporation, including how equity ownership by managers aligns manager's interests with those of owners (Jensen and Meckling 1976), discussed the role of efficient capital and labor markets as information mechanisms used to control the self-serving behavior of top executives (Fama 1980), and described the role of the board of directors as an information system that the stockholders within large corporations could use to monitor the opportunism of top executives (Fama and Jensen 1983).

The principal-agent stream focused more directly on the contract between the principal and the agent in search of the most efficient alternative in a given situation. This paradigm is characterized by specification of assumptions, mathematical proofs, determination of the optimal contract, in terms of behavior versus outcome, between the principal and the agent. The two most cited problems are the moral hazard (lack of effort on the part of agent), and the adverse selection problem (misrepresentation of ability by the agent). Both are associated with the difficulty in observing the agent's behavior. By adding and relaxing various assumptions on information, the principal agent paradigm derives several formal propositions on the effectiveness of alternative contracts between a

principal and an agent. Influential studies in this area were those by Anderson (1985), Eisenhardt (1985, 1988), Conlon and Parks (1988), and Eccles (1985).

The Property Rights Approach

The property rights literature originated in the postwar period when criticism of the traditional theory of production and exchange mounted. In that era, property right structures began to be recognized as important determinants of economic outcomes. Although the basic neoclassical model was maintained, additional constraints regarding property rights and other institutional environment variables were incorporated. The contributors, although diverse in style and content, were characterized by a common emphasis on certain basic ideas concerning the interconnnectedness of ownership rights, incentives, and economic behavior. Modifications of the conventional analytical framework, introduced by early theorists include: (1) a shiftaway from organizations *per se* to individuals who seek their own interests and attempt to maximize their utility subject to the constraints imposed by the existing organizational structure, (2) a detailed analysis of the interrelations between institutional arrangements and economic behavior by considering the effects of various possible property rights assignments on the penalty-reward system, and (3) a recognition of transaction costs as being greater than zero in virtually all cases of practical importance (Furubotn and Pejovich 1972).

The above modifications helped economists better understand and study the implications of various property rights assignments such as resource allocation, externalities, and common property problems, and particularly contributed to the theory

of the firm (Demsetz 1964, 1967; Alchian and Demsetz 1972; Furubotn and Pejovich 1972; Hart 1986, 1995; Grossman and Hart 1986; Hart and Moore 1990; Milgrom and Roberts 1992; Holmstrom and Milgrom 1994; De Alessi 1983; and Barzel 1989, 1997).

The theory of the firm, as developed from the property rights approach tries to answer such questions as: What is a firm? What are the boundaries of a firm? What are the determinants of vertical integration of the activities of the firm? Where transactions should be carried out within a firm or through the market? Which assignment of property rights enhances firm efficiency under specific circumstances?

The Development of the Property Rights Approach

Developments Until 1990

As mentioned previously, the property rights approach was first introduced by Alchian (1959, 1961, 1965), Demsetz (1964), and Alchian and Demsetz (1972), in an attempt to extend the neoclassical theory of the firm. These authors explored the constraints associated with the property rights embedded in various institutions.

Subsequent steps included the analysis of the costs of establishing, monitoring, and enforcing alternative systems of property rights to further the understanding of the evolution and adoption of specific contractual and institutional arrangements, and their affects on the structure of transaction costs. Numerous definitions of property rights are found in the property rights literature (Table 2.1).

Partitioning property rights leads to a variety of ownership structures. These alternative structures result in different arrangements among the asset's owners, with respect to the allocation of costs and benefits associated with ownership of an asset. Thus, they directly affect all decisions asset-owners make regarding the asset's use.

If all property rights were privately held and transaction costs zero, such rights would be fully delineated, allocated, and enforced, and there would be no external effects. All future value consequences would be fully capitalized into current transfer prices. Accordingly, individuals making choices about an asset would bear, and have the incentive to take in account, all resulting harms and benefits (Barzel 1989, 1997).

Table 2.1: ALTERNATIVE DEFINITIONS OF PROPERTY RIGHTS
MacPherson (1978): "The very idea of property, therefore, is the idea of an individual right. ...It is an enforceable claim to some use or benefit of something (and sometimes, but not always, to its disposal): it is not the thing itself."
Schmid (1978): "Property rights describe the relationship of one person to another with respect to a resource or any line of action. ...Rights are the instrumentality by which any society controls and orders human interdependence and resolves the question of who gets what."
Alchian (1979): "In the rights of a person to a resource, we include the probability that his decision about demarcated uses of the resource will result in that use, in the sense that his decision dominates that of any other person."
Randall (1981): "Property rights specify the proper relationships among people with respect to the use of things, and the penalties for violations of those relationships."
De Alessi (1990): "Property rights are the rights of individuals to the use, income, and transferability of resources. The bundle of rights associated with a particular resource typically is partitioned; some rights may be held in common with open access, some may be held privately."

Table 2.1: ALTERNATIVE DEFINITIONS OF PROPERTY RIGHTS (Continued)
Condon (1990): "Property rights are social institutions, expressed as legal; restrictions, that are devised in order to place constraints on how the resources available to an economy may be used. Property rights specifically address; who may make decisions over a particular resource's use, who will bear the risk of gain or loss as a result of employing the resource in some productive activity, the length of time, the right may be considered valid, the circumstances under which the right can be transferred, and the penalties to be incurred for violations of the privileges inherent in the rights."
Eggertsson (1990): "The rights of individuals to use resources. They are of three types; user rights, the right to earn income from an asset, and the right to transfer ownership."
Barzel (1997): "I define the economic property rights an individual has over a commodity (or an asset) to be the individual's ability, in expected terms, to consume the good (or the services of the asset) directly or to consume it indirectly through exchange."

However, transaction costs are positive in most cases of economic interest. Therefore, some property rights will not be fully defined, allocated, and/or enforced. A change in the system of property rights and transaction costs, implies a change in the consequences individuals bear as a result of their actions, and their behavior is affected accordingly (Alchian 1967). Therefore, the property rights structure itself enters into the individual utility functions.

Much of the initial work on the economics of property rights included theoretical analyses of the consequences of different ownership arrangements, or studies on the evolution of property rights (De Alessi 1990). With few exceptions (Williamson 1963; Furubotn 1974), most of this literature was non-mathematical and illustrated by anecdotal or relatively informal evidence.

Subsequently, however, a number of formal models were introduced, focusing on the implications of alternative property rights structures and testing of hypotheses derived

from such models by means of sophisticated econometric techniques began (e.g., Furubotn 1976; De Alessi 1980).

The property rights approach was utilized to study a wide range of important issues, starting with the fundamental question of "why firms exist." Alchian and Demsetz (1972), building on earlier work by Coase (1937) hypothesized that the nexus of contractual arrangements known as the firm arises to solve the shirking-monitoring problem of team production when the production function is not separable. In the privately owned firm, the problem of shirking by monitors is solved by assigning to the owners of the firm-specific assets both the authority to monitor the inputs and the residual claim to the net earnings of the team (Williamson 1975; Klein et al. 1978; Barzel 1987).

Not-for-profit, public, and other non-privately owned firms have also been studied in the property rights literature. These firms share one common characteristic, namely, no one can claim the right to appropriate the residual (Alchian and Demsetz 1972). Therefore, the future consequences of current managerial decisions cannot be capitalized. As a result, the management of these firms has unusual scope for increasing its non-pecuniary income at the expense of the firm's customers and patrons (Furubotn and Pejovich 1972), and thus, the shirking problem is expected to be more severe in these types of firms.

Furthermore, the property rights model has been applied to the study of issues such as:

(i) the choice of business organization (Alchian and Demsetz 1972; Williamson 1976; Hansmann 1988, 1996),

(ii) the choice of financial structure (Jensen 1986; Aghion and Bolton 1992),

(iii) the payment of dividends (De Alessi and Fishe 1987),

(iv) the problem of moral hazard in teams (Holmstrom, 1982),

(v) optimal bargaining mechanisms (Myerson and Satterthwaite 1983),

(vi) the effect on specific investment of incomplete contracts with the opportunity to renegotiate when new information becomes available (Tirole 1986),

(vii) the ownership of the residual rights of control as a lower-cost alternative to contracts that seek to specify who will control each dimension of a contract under each alternative future contingency (Grossman and Hart 1986; Hart 1988), and

(viii) employment contracts when changing jobs is costly (Milgrom 1988).

Empirical work in the above areas has been inconclusive with respect to most of the theoretically derived hypotheses and is presented later in this chapter. However, this research sheds light on details of the theory and has led to the development of more rigorous theoretical models in the 1990's

Developments in the Post-1990 Period

In the 1990's the property rights literature increased in rigor and sophistication as scholars studied asset and firm ownership in more detail. The basic notion that property rights dramatically affect the incentives of economic actors, and thus their willingness to support efficient economic outcomes, remains central today. Although various contributors sometimes hold different views on important questions, the most significant issues addressed in recent years include: (1) what is a firm, (2) why do firms exist, (3)

how is firm size determined, (4) what are the costs associated with contractual incompleteness, (5) what are transaction costs, (6) how is effective ownership defined, (7) what are the implications of alternative ownership structures, and (8) what is the importance of physical versus human assets in firm ownership?

Hart and Moore (1990) define the firm as the sum of assets that its owners control, and view it as a means for dealing with contractual incompleteness, which is inescapable in the presence of positive transaction costs. Hart (1995), and Milgrom and Roberts (Chapter 9, 1992) although agree with this definition of the firm, the latter see the firm's purpose is to deal with the problems generated by incomplete contracts. Hart maintains a more general point of view seeing the firm as a way to concentrate ownership of complex assets and thus provide individuals (i.e., firm owners) with incentives for efficient resource allocation.

In sharp contrast is Barzel's (Barzel 1997) view of the firm as a nexus of outcome guarantees where capital-rich owners guarantee the outcome variability of capital-poor owners, thereby making the capital-rich owners of the firm as the major holders of the firm's residual control rights.

Another puzzling issue proposed by Coase's article[8] (1937) concerned the determination of the boundaries of the firm. Barzel extended his view on the role of the firm by arguing that the economies and diseconomies of scale to which capital is subject determine the firm's size. Hart, on the other hand, maintains that ownership of assets

[8] Coase, Ronald. "The Nature of the Firm," *Economica*, 4(n.s.), (1937): 386-405. Reprinted in R.H. Coase, *The Firm, the Market, and the Law, Chicago; University of Chicago Press, (1988): 33-55.*

concentrates within a single firm so that alignment is achieved between residual rights of control and residual claimant rights over important assets. In this way, investment distortions due to fear of hold-ups are avoided. Hart and Moore use the same arguments in their article, while Milgrom and Roberts focus mostly on a transaction cost explanation for the firm's degree of vertical integration. According to their approach, the various characteristics of the transactions (i.e., asset specificity, duration and frequency, connectedness, complexity, difficulty of measuring performance) in which the firm is engaged, determine the firm's size. Transactions will be internalized to avoid opportunistic behavior associated with incomplete contracts resulting from positive transaction costs.

Contractual incompleteness and the resulting costs are also central in most post-1990 developments[9]. Milgrom and Roberts, and Hart and Moore, focus on the costs of investment distortions due to fear of hold-ups. Hart also adds the costs of renegotiating a new contract, as well as the costs of failing to reach a new efficient agreement due to asymmetric information. Barzel defines the costs resulting from incomplete contracts by associating them with the reduction of total output an asset generates. When contracts are incomplete, Barzel argues, property rights will not be fully delineated over all of an asset's attributes. In such a situation, individuals will be motivated to capture as large a part of the generated output as possible, which in most cases leads to a reduction in the total output of the asset.

[9] Focus on incomplete contracts has been so intense during recent years that scholars very often talk about the property rights/incomplete contracts approach.

Barzel's definition of transaction costs as those associated with the transfer, capture and protection of property rights, nearly coincides with Jensen and Meckling's (Jensen and Meckling 1976) definition of agency costs. Hart defines transaction costs as those associated with writing complete contracts. Since writing complete contracts is nearly impossible, transaction costs will be positive in most cases. On the other hand, Hart and Moore, Milgrom and Roberts, as well as Williamson (e.g., Williamson 1996) use a more traditional definition of transaction costs, as those associated with carrying out a transaction or the opportunity costs incurred when an efficiency-enhancing transaction is not realized.

Research in the property rights literature focused on two issues: first, how is effective ownership of an asset (and a firm) defined, and, second, what are the most important implications of alternative ownership structures. Hart and Moore maintain that effective ownership of an asset is directly related to the possession of the residual rights of control over that asset; the right to decide how the asset is to be used, except that specified in a previous contract. The authors ascribe a more specialized meaning to residual control rights, in that they suppose that the sole residual right is the ability to exclude others from the use of that asset.

Hart (1995), argues that for a relatively simple asset the same person should hold residual rights of control and residual claimant rights to enhance efficiency. However, his discussion primarily centered on the importance of residual control rights with minimal reference to residual claimant rights. Milgrom and Roberts (1992), agreeing with Hart,

hold that the alignment of residual control rights and residual claimant rights is a necessary condition for effective ownership. However, they argue that for more complex assets, such as the stock corporation, the concept of effective ownership is highly elusive and should be applied with caution in economic analyses.

Barzel's view conveys the same ideas about the effective ownership of an asset, though phrased in a different language. His proposition states that an individual's share in the residual income from an asset should increase as her contribution to the mean output generated from that asset increases and likewise should decrease as her contribution to the mean output decreases.

With respect to the implications of alternative ownership structures, Barzel maintains that the major effect comes through changes in the incentives facing individual economic actors. An example of this is the common resource problem, associated with the right of fishing in the ocean. When these rights are not clearly defined, individuals will tend to increase their catch, and the danger of over-fishing is high.

In alternative ownership agreements, Hart and Moore, and Hart see another side to the incentive problem as an inefficient ownership structure where investments in highly productive asses will never be made because they are usually subject to hold-ups and other types of opportunistic behavior. The person who has the residual rights of control over an asset will choose to invest in that asset without fear of opportunistic behavior. With dispersed ownership however, the fear of hold-ups can become so severe that investments in highly specific assets are avoided.

A well-known example of the hold-up problem is given by Hart (1995); the General Motor—Fisher Body example. In the 1920's GM was outsourcing its car bodies to Fisher Body. As auto-manufacturing technology improved, however, GM asked Fisher Body to build a new plant adjacent to its car manufacturing plant, in order to minimize delays and transportation costs. Arguably[10], Fisher Body recognized that by investing in a plant tailored to the specific needs of GM, it would be vulnerable to post contractual opportunism by GM, which could force lower car body prices—as happened when demand for car increases in the late 1920's. Therefore, Fisher Body refused to invest in the new plant fearing hold-up and, subsequently, GM bought out Fisher Body.

Milgrom and Roberts confine their discussion of effective ownership to relatively simple asset structures, arguing that complex organizations with numerous assets, as being too difficult, if not impossible, to define who is the residual claimant or who has the residual control rights over an organization's most important assets. Yet, they conclude their analysis by pointing to ownership as the most common and effective means to create, maintain, and improve assets.

Finally, the last issue under debate in the recent property rights literature, is the relative significance of physical compared to human capital in firm ownership. Hart and Moore, Hart, and Barzel, argue that ownership of physical assets is more important than "ownership[11]" of human assets. For example, Hart (1995, p. 56) argues that:

[10] The author is knowledgeable of forthcoming work by Ronald Coase, which gives an alternative (non-hold-up) explanation of the GM-Fisher Company merger.

[11] Quotation marks are used here to denote that human capital cannot be owned, but only be employed – since slavery is illegal.

"To understand better the role of non-human assets, consider a situation where 'firm 1 acquires 'firm 2, which consists entirely of human capital. Ask the following question: what is to stop firm 2's workers from quitting, possibly *en masse*? In the absence of any physical assets—e.g. buildings—firm 2's workers would not even have to relate physically. For example, if they are linked by telephone or computer terminal (assets which they own themselves), they could simply announce one morning that they have become a new firm.

For firm 1's acquisition of firm 2 to make any economic sense, there must be some source of firm 2 value over and above the workers; human capital, i.e. some 'glue' holding firm 2's workers in place. This source of value may consist of as little as a place to meet; the firm's name, reputation, or distribution network; the firm's files, containing important information about its operations or its customers; or a contract that prohibits firm 2's workers from working for competitors or from taking existing clients with them when they quit. The source of value may even just represent the difficulty firm 2's workers face in co-ordinating a move to another firm. But without something holding the firm together, the firm is just a phantom."

Milgrom and Roberts argue that certain human capital assets such as workers' and managers' skills and knowledge are organization-specific and hence non-transferable, thus rendering effective ownership performance. Various concepts of the property rights approach to the theory of the firm are summarized in Table 2.2.

Table 2.2. Alternative Property Rights Approaches to the Theory of the Firm in the 1990's

QUESTIONS	Hart and Moore (1990)	Milgrom and Roberts (1992)	Hart (1995)	Barzel (1997)
What is a Firm?	The assets that its owners control	Complex agglomeration of assets	Nexus of contracts	Nexus of outcome guarantees
Why Firms Exist?	Contractual incompleteness	Contractual incompleteness	To concentrate ownership of complementary assets; provide incentives for efficient resource allocation	Capital-rich owners guarantee the outcome variability of capital-poor owners
How is Firm Size Determined?	Optimum degree of integration when investment incentives and disincentives for the two firms are balanced effectively	By the characteristics of the transactions described in the incomplete contracts in which the firm is engaged	Alignment of residual rights of control and residual claimant rights to avoid investment distortions due to fear of hold-ups	By economies and diseconomies of scale to which capital is subject to
Costs of Contractual Incompleteness?	Cost of investment distortions due to fear of hold-ups	Cost of investment distortions due to fear of hold-ups	(a) renegotiation costs, (b) costs of failing to reach new efficient agreements due to asymmetric information, (c) cost of investment distortions due to fear of hold-ups	Costs associated with reduced total output that an asset can produce
Definition of Transaction Costs?	Costs of carrying out a transaction or the opportunity costs incurred when an efficiency-enhancing transaction is not realized	Costs of carrying out a transaction or the opportunity costs incurred when an efficiency-enhancing transaction is not realized	The costs of writing complete contracts; positive for most transactions	The costs associated with the transfer, capture, and protection of property rights
Definition of Effective Ownership?	Possession of residual rights of control	Alignment of residual rights of control with residual claimant rights	Alignment of residual rights of control with residual claimant rights; however residual rights of control are critical	A person's share in the residual income from an asset should increase as her contribution to the mean output increases, and vice versa
Implications of Alternative Ownership Structures?	Change in incentives to invest in assets subject to hold-ups and opportunistic behavior	Ownership is the most common and effective means to motivate people to create, maintain, and improve assets	Change in incentives to invest in assets subject to hold-ups and opportunistic behavior	Changes in incentives to increase or decrease the total output an asset can generate
Physical vs. Human Assets?	Ownership of physical assets is more important	Ownership of physical and human assets are equally important	Ownership of physical assets is more important	Ownership of physical assets is more important

Property Rights Theory of the Firm: Empirical Evidence

During the last twenty-five years the theoretical work regarding the incorporation of the property rights approach into the theory of the firm advanced and generated a number of important hypotheses. However, empirical work did not progress at the same pace. Most of the empirical evidence referred only to general propositions and failed to test detailed hypotheses.

In the 1960's and 1970's, the central question in most empirical analyses was "how do alternative ownership structures affect the incentives of the various stakeholders of the firm and how does that affect firm efficiency?" The results however were not conclusive because it was not clear whether the choice of a property rights system was the result of efficiency considerations, or whether efficiency was a function of the property rights structure and thus causality could not be determined. In addition, empirical work during these two decades failed to provide insights on why "seemingly inefficient organizational structures are established and survive.[12]" In spite of these limitations, many useful insights were gained through empirical tests of the basic property rights propositions and served to keep the interest of scholars alive thus leading to further investigation.

Various business forms were studied in the 1960's, and especially in the 1970's. Furubotn (1974) examined Yugoslavian firms for the effect of worker ownership and management on their capital investment decisions and found that labor-managed firms

[12] De Alessi (1980, p. 5)

had a higher debt to equity ratio than conventional firms, primarily because those workers tended to pay themselves higher wages. Moore (1980) provides similar evidence, but is more careful in drawing absolute conclusions.

Jones and Backus, using a sample of labor-managed firms from the UK footwear industry tested the hypothesis that such firms tend to operate in the region of increasing returns to scale, due partly to the non-transferability of ownership rights characterizing these firms (Vanek 1977). Although they found no evidence of increasing returns to scale, their sample was relatively small, suggesting that conclusions be drawn with caution.

Ownership arrangements in mutuals (e.g., Nicols 1967; 1972), franchises (Shelton 1967; De Alessi 1973; Stano 1975) and other non-proprietary forms of business firms (Frech 1976; 1979; De Alessi 1979; Oi 1979) were in most cases associated with small samples, absence of data on IOFs enabling comparative studies, improper measurement of important variables, and lack of specificity n stating hypotheses to be tested (Bonin, et al. 1993). A detailed presentation of the empirical work done on the use of the property rights theory of the firm and other applications can be found in De Alessi (1980).

Starting in the 1980s, empirical work began on the alternative forms of firm organization and ownership structure, and alternative ownership arrangements and employee incentives. Cordell et al. (1993) tested a number of property rights propositions regarding the relative efficiency of mutual and proprietary companies in the savings and loans (S&L) industry. Using dummy variable regressions, they found

significant evidence that demutualization increased the riskiness of the S&L industry but did not find that stock S&Ls were on average more profitable than mutual S&Ls.

Mayers and Smith Jr. (1988) focused on the impact of ownership structure (stock, Lloyd, mutual, and reciprocals companies) on cross-sectional differences in the US insurance industry across lines, while controlling for firm size. Although their findings suggest important differences among these types, the authors could not interpret some of the observed differences and thus their results lose a large part of their explanatory power.

Estrin and Jones (1992), tested the widely accepted proposition that labor-owned firms either will fail or be converted into IOFs as the proportion of hired non-member workers inevitably increases. However, data from French producer cooperatives for the years 1970-79 provided evidence against this prediction. Instead there was a high rate of survival among the producer cooperatives studied, with many still healthy after fifty years of operation. Furthermore, the majority of cooperatives in their sample did not degenerate into an IOF. Additionally, Estrin and Jones studied the capital structure of producer cooperatives and its implications for their survival and growth. According to their findings, the threat to survival manifests itself in the capital structure, but as the cooperative begins to earn surpluses, these can be used to accumulate collective reserves and reduce workers' equity stakes. Hence, as average collective reserves rise the debt to equity ratio and individual workers' capital stakes proportionally fall. The accumulation of reserves appears to be sufficient to finance the increase in fixed assets required to maintain the optimal capital-ratio at gently rising levels of employment, though some

cooperatives reach some maximum use and then stop growing altogether. On the other hand, older cooperatives become capital-rich and unwilling to use their accumulated funds in either internal growth, which could threaten the cohesiveness of the cooperative, or in diversification, which brings little benefit to workers with non-tradable[13] tradable holdings.

Mascarenhas (1989), using the offshore drilling industry focused on the study of relating ownership to domain differences among state-owned, publicly traded, and privately held firms in international competition. His findings suggest that ownership may provide a theoretical, parsimonious approach to understanding international strategic space by explaining selected differences in domestic market dominance, international presence, and customer orientation, while controlling for firm nationality, size, and line of business. Publicly traded companies exhibited generalism by operating in many geographic markets and offering a wide array of products. State-owned firms focused on their domestic market with a narrow product line and a stable customer base. Although privately held firms also operated domestically with a narrow product line, they have an unstable customer base.

Belkaoui and Pavlik (1992) using a cross-sectional data set of 228 Fortune 500 firms tested the hypothesis that ownership structure and diversification explain differences in performance between firms. Their results show a significant non-monotonic relationship between performance and ownership structure and a positive direct relationship between performance and related and unrelated diversification. These

[13] For a full review of both empirical and theoretical studies on producer cooperatives see Bonin et al. (1993).

findings suggest that indeed, ownership structure is a critical factor in determining firm performance.

Ehrlich et al. (1994), compared the effect of state versus private ownership on the rates of firm-specific productivity growth and cost decline. They developed a model of endogenous, firm-specific productivity growth and tested its implications against panel data on twenty three international airlines with varying levels of state ownership, from 1979 to 1983.Their results indicate that state ownership can in the long run lower the rate of productivity growth, but not necessarily in the short run. However, the authors admit that observed differences in productive efficiency across private and state-owned firms may also be a function of the age distribution of the firms being compared.

Pencavel and Craig (1994), studied the plywood manufacturing industry in the Pacific Northwest from the late 1960's to the mid 1980's by comparing the reactions of cooperative firms and IOFs to changes in their input and output prices and found their reactions to be consistent with orthodox models of profit (for IOFs) and dividend (for cooperatives) maximization.

Boardman and Vining (1989) selected a set of five hundred Fortune 500 companies to examine performance differences between state-owned, mixed, and private enterprises. They hypothesized performance to vary with type of ownership, industry and country, dollar amount of assets, degree of industry concentration, sales, number of employees and market share. They concluded that large state-owned and mixed industrial enterprises perform substantially worse than similar private companies—after controlling for a wide variety of factors.

Ferguson (1983), studied the significance of ownership structure to the level of efficiency in the mass media industry and found that ownership concentration tends to minimize advertising costs and achieve economies of scale, especially when assets are co-specialized.

Davies and Brucatto (1987) examined the role that property rights play in explaining differences in economic behavior in the Australian banking industry. They found two distinct forms of ownership, firms with non-transferable common ownership among taxpayers and firms with transferable private ownership. Their empirical results, derived by applying the property rights approach, were in agreement with their hypotheses, namely that the latter type of firm is more efficient. However, Chalk (1987) and Bonus (1987) criticized the empirical results from this study on grounds of irrelevant proxy variable choices and failure to include the full extent of institutional arrangements in the constraints facing individual actors within the industry.

Frech (1985) in examining the US nursing home industry found that private non-profit and government firms incur higher costs, attributable to their attenuated property rights structure. However, these results were questionable because the observed differences may reflect variations in output, which cannot be assumed away due to the nature of the data.

Troesken (1997), developed three theories of public ownership and tested them on 1911 historical data of 1274 public and private gas companies and found support for the property rights theory.

A second category of empirical work of alternative ownership arrangements concerned their effect on employee incentives. Hexter and Hu (1993), using samples of Fortune 500-sized companies in 1976, 1980, and 1984, found that corporate value (measured by Tobin's q) to be a function of management ownership but the relationship was non-monotonic.

Papaioannou et al. (1992) examined the relationship between corporate liquidity and managerial ownership in the firm's stock but failed to find any significant impact of managerial stock ownership, but did find that firm liquidity is positively related to the firm's ability to earn economic rents.

Jones (1993), using a sample of sixty-three Polish producer cooperatives in three industries during the period 1976-78, studied the effects of worker participation on productivity. Jones' results indicate that worker participation in control and/or in economic returns provided positive effects on productivity. Lichtenberg and Siegel (1993), studying changes in ownership of a firm on the employment concluded that employment growth changes dramatically when establishments change owners.

MacCormick and Meiners (1988) examining university departments also found support for a number of property rights propositions. Their evidence suggested that faculty governance reduces university quality, and that faculty performs poorly when they are assigned managerial responsibilities. However, they were unable to answer the question of why schools continue to allow faculty to participate in decisions that, according to the authors' theory and evidence, they are not fully competent to handle.

Jones and Pliskin (1989), examined profit-sharing schemes and found that their effect is dependent upon the way in which they are measured, how dynamic the model is, and whether or not employees' participation in decision making is included in the estimating equation. Moreover, their results indicated that the effects might be critically dependent on the institutional setting.

Finally, Demsetz and Lehn (1985) found the most significant variables in explaining the variation in ownership structure for 511 US corporations were firm size, instability of profit rate, and the nature of industry. Their results also cast doubt on the Berle-Means theoretical hypothesis, as no statistically significant relationships were found between ownership concentration and profit rates.

In summary, the evidence presented on the property rights propositions regarding the theory of the firm, is far from conclusive. Much more emphasis needs to be placed upon recent theoretical developments that depart from the very general propositions arising from the simple theory of attenuated property rights. The growing sophistication of multivariate analysis techniques, may now enable more detailed empirical tests of new theoretical insights. Especially in the area of economic incentives facing individual actors within the firm, standard econometric analysis is not always the most appropriate method. The role of latent variables and two-way causal relations should be explored in the context of complex relationships, resulting from less clearly delineated property rights. Finally, more rigorously formulated theoretical models would make empirical work much easier and the obtained empirical results more robust.

Criticisms of the Property Rights Model

While the property rights approach constitutes a powerful theory of the firm, and particularly firm ownership, it has been criticized for failing to explain why some firms outperform others (Barney and Hesterly 1996). The property rights model assumes that firms are essentially homogeneous in their transaction-minimizing and incentive mechanism-designing skills, therefore cannot be sources of competitive advantage or superior performance for any one firm.

However, Barzel in his latest contribution to the property rights literature (Barzel 1997) viewed the firm as a nexus of outcome guarantees which may provide a partial answer to this criticism. Since the ability of firm owners to guarantee outcome variability differs between firm owners, firms' competitive positions will also vary. However, this answer too is far from complete.

Peters (1993) focuses on the ownership and incentive differences between for-profit and not-for-profit firms, in what he calls "the simple theory of attenuated property rights." Citing a number of empirical studies supporting his arguments, Peters suggests that the assumed attenuation of property rights and the resulting disincentives for the achievement of efficiency in non-profit firms may actually not correspond to reality.

Peters concludes by mentioning that:

> "Those differences across ownership types that do emerge from comparative work must also be considered in the objective context of the specific industry and relevant markets, rather than ascribed merely to ownership form, and should be analyzed in terms of the internal structures of the firms. As Barzel (1989, pp. 102-107) has correctly observed, the challenge is to understand the property rights that do exist, rather than to simply argue that these rights must be attenuated in public firms (see also Bonus, 1987; Hellman, 1972, p. 57). It is time to abandon the simple

> theory of attenuated property rights, and move on to consider the varieties of attenuation and their implications for efficiency and welfare."

This research addresses Peters' recommendation by proposing a comprehensive and empirically tested property rights theory.

Application of the Property Rights Approach to the Study of Agricultural Cooperatives

Between 1940 and 1980, most of the models of the cooperative enterprise were based on extensions of the neoclassical theory[14] (Staatz, 1987). The cooperative firm was viewed as a simple entity with the manager maximizing (or minimizing) a single and well-defined objective. Subsequently, as cooperative firms became increasingly complex and heterogeneous, these models failed to address a number of important questions.

By the 1980's, cooperative theorists/thinkers were searching for alternatives to the neoclassical theory of the firm framework, to better understand and explain the cooperative firm's strengths and weaknesses and thus its potential for survival. As questions arose about the justification of public policy support for cooperatives, economists were faced with answering them in the best possible way. The major factors under these questions were: (1) market failures, in both the input and output markets for farmers, that resulted from the farm crisis of the 1980's, (2) declining cooperative market shares after 1982, (3) the restructuring/redesigning of IOFs aimed at increasing their competitiveness, (4) the globalization of agribusiness, (5) the industrialization of

[14] Staatz (1987) presents some exceptions to this trend. Several scholars, particularly from Europe, argued, as early as the 1950's, that the cooperative could be viewed as a coalition of participants, each of which have its own objectives and participates in the organization as long as it feels its objectives are being met

agriculture, (6) declining membership, especially in the numbers of medium size farms which traditionally have been the strongest membership base for co-ops, (7) uncertain export markets and chronic over-supply, (8) the expected termination of government support of agricultural producers, (9) the growth in the average size of business entity and its challenge to the role cooperatives play in concentrated markets[15], (10) the increase in the size of cooperatives with its resulting heterogeneous membership which pose dilemmas about the ability of a cooperative to serve its diverse membership, and (11) the increased complexity of cooperative business that necessarily leads to the delegation of more and more authority to hired management, and thus a concern about whether the organization is still controlled by its members, and whether cooperatives really differ from IOFs.

The existing body of theory regarding cooperatives however, could not address the above issues. As Condon (1990, p. 10) noted,

> "current models of cooperative behavior are particularly lacking in treatment of the institutional economic factors that distinguish cooperatives from the other forms of organizing economic activity. As a result, there exists little or no theoretical treatment of cooperatives in a dynamic context, because analysts do not yet recognize that cooperative ownership and organization may have a direct impact on these firms over time in such areas as the incentive structure for attracting member-patron investment capital."

In searching for new approaches to the theory of the cooperative firm, theorists looked to recent developments such as (a) Neo-institutional economics, and particularly, transaction cost economics and the economics of property rights, (b) Game Theory, and (c) strategic management theory.

[15] 9, 10, and 11 are given by Staatz (1987c).

Condon (1987) established the importance of incorporating property right assumptions into economic theory generally, and the cooperative firm particularly. He argued that the role and motivation of cooperative stakeholders (members, board of directors, and management) can only be studied with respect to the incentives facing them, and that these incentives change dramatically with changes in the property rights structure. Furthermore, scholars argue that property rights have a significant impact on cooperative structure and performance as well as important public policy implications.

Vitaliano (1978; 1983; 1985), Condon (1987; 1990), and Cook (1995), using recent developments in the economics of property rights addressed the five property rights constraints analyzed in the next chapters. Gradually, the property rights approach was applied to the cooperative firm. Ideas and theories from the evolving Neo-institutional literature applied to cooperatives and provided new insights into the economics of the cooperative business organization. However, in spite of this new approach, the incorporation of these pieces into a more general theory of the cooperative firm is far from complete. Additional steps required in the development of a more comprehensive theory include: first, the study of alternative cooperative organizational designs and, second, decide on the nature of the cooperative firm as a special case of the general theory of the firm, or an alternative organizational form. In this case, the latter may require a new research agenda. Third, the continuing study of the investment

constraints resulting from alternative property rights structures should be accompanied by an analyses of the effect these structures have on collective decision making.

Finally, another crucial prerequisite for the development of a comprehensive property rights theory of the cooperative firm, is the empirical testing of the derived theoretical propositions. Tests are necessary to: (1) allow the evaluation of the strengths and weaknesses of the property rights approach in explaining important aspects of the cooperative firm; (2) enable researchers to improve theoretical models of the cooperative organization, and (3) reinforce more rigorous theoretical work. A number of qualitative and quantitative techniques (e.g., case studies, multivariate analysis techniques) exist now, that allows this advanced empirical work.

CHAPTER THREE

VAGUELY DEFINED PROPERTY RIGHTS CONSTRAINTS: INVESTMENT CONSTRAINTS

Generic Characteristics of Firm Property Rights

Most advanced economies of the world, have a number of different forms of business organizations; partnerships, IOFs, sole proprietorships, cooperatives, mutuals, labor-managed firms, and nonprofit organizations are the most prevalent among them. The distinguishing characteristics of these economic organizations lies in the nature of the property rights that describes ownership and control of the resources and in the way residual control rights and residual claimant rights are determined over a firm's most economically important assets (Hart and Moore 1990). The rights considered of prime importance in defining the ownership structure are those that specify who is the residual claimant, and who has residual control rights (Milgrom and Roberts 1992).

The claims to the gross cash flow an organization can generate are of two kinds. Fixed claims are pre-specified payments contracted to those supplying the firm with goods and services. For example, wages, repayment of loans, taxes, and building repairing, constitute fixed claims. Residual claims refer to the right to the firm's net cash flows after all fixed obligations have been met (Fama and Jensen 1983b).

New institutional economics literature (e.g., Fama and Jensen 1983b; Hart and Moore 1990; Hart 1995) identifies four characteristics of the property rights structure in any organization: (1) ownership of residual claims and alignment of residual control and residual claimant rights, (2) transferability of residual claims, (3) redeemability of residual claims, and (4) ownership horizon of residual claims. The valuation characteristic, which refers to the way in which the value of residual claims is established, is not included here since it is implied in transferability and appreciability.

The form of residual claim ownership has important implications for a firm. For example, the number of persons who own the residual claims determines the way risk bearing is assumed within the organization (Jensen and Meckling 1976). With more claimants less risk accrues to each individual and the firm can assume a higher risk in making investments. Likewise, residual control rights over a firm's assets significantly affects the net income the asset generates, and alters the importance of holding the residual claims.

Residual claim ownership is affected by the degree of alignment between residual control rights and residual claimant rights. However, definite conclusions on what constitutes effective ownership have not yet been reached, as scholars hold different views on this issue. Most scholars agree with Milgrom and Roberts (1992), who argue that for simple assets ownership should be given to those having residual control rights, thereby increasing incentives for creating, maintaining, and improving the assets. This proposition is critical in understanding alternative property rights structures of

contemporary agricultural cooperatives. When residual control rights and residual claimant rights are not aligned within an organization, economic decisions made by the organization's stakeholders tend to be inefficient.

Transferability refers to the ease of transfer of a residual claim from one person to another. Some firms place restrictions on the transfer of their residual claims (e.g. cooperatives), while others permit free exchange (e.g., IOFs).

Redeemability defines the degree of ease with which the owner of a residual claim can demand, at a given price, return of equity that purchased the rights to the net income of the firm, as observed in cooperatives and mutuals. Ownership horizon pertains to the length of time the residual claim remains valid. Workers of production cooperatives hold residual claims only as long as they work for the firm (Jensen and Meckling 1979). Residual claims to the net income of consumer cooperatives remain valid only as long as a member patronizes the cooperative store.

Characteristics of Property Rights in Traditional US Agricultural Cooperatives

The property rights structure observed in traditional US agricultural cooperatives differs markedly from other types of firms. In cooperatives, the characteristics of property rights (ownership, transferability, redeemability, and time horizon) are determined by cooperative principles[16] and are enforced by cooperative regulations (Subchapter T,

[16] Barton (1989, p. 23) defines a principle as a governing law of conduct, a general or fundamental truth, a comprehensive or fundamental law.

Section 521, state incorporation statues, antitrust exemptions, SEC regulations and cooperative bylaws; Hardesty 1992b).

The above build an institutional environment which creates and promotes a property rights structure characterized by non-transferable, non-redeemable and limited time horizon residual claims that results in misalignment of residual rights of control and residual claimant rights. In turn, this structure creates an organizational environment in which the decisions made by cooperative stakeholders tend to be inefficient and thus cooperatives' ability to compete in today's agribusiness chains based on purely economic criteria is seriously diminished.

Hardesty (1992b, p. 6) studied cooperatives' ability to effectively market value-added products and argues that:

> "Cooperative regulations and principles block access to capital from certain sources and inhibit the retention of existing equity capital. Cooperatives' competitiveness can also be undermined in less obvious ways. The user-controlled principle constrains cooperatives' abilities to be market-oriented and to engage in solid strategic planning. The fact that cooperative members earn returns on the basis of their patronage, rather than their investment, can cause reluctance to invest in advertising and product development needed to become market-oriented. The requirement for management experienced with value-added products can easily be overlooked because there is no secondary market for members' equity and managerial control is subsequently left to a producer-oriented board."

Cooperative Principles, Regulations, and Property Rights

Cooperative principles have originated in the business practices and guidelines adopted by the famous consumer cooperative of Rochdale in the mid-nineteenth century England. These principles were:

1. Voting is by members on a democratic (one-member, one-vote) basis.
2. Membership is open.
3. Equity is provided by patrons.
4. Equity ownership share of individual patrons is limited.
5. Net income is distributed to patrons as patronage refunds on a cost basis.
6. Dividend on equity capital is limited.
7. Exchange of goods and services at market prices.
8. Duty to educate.
9. Cash trading only.
10. No unusual risk assumption.
11. Political and religious neutrality.
12. Equality of the sexes in membership.

Several alternative sets of principles have been adopted during different periods and in different countries during the twentieth century, all of which were merely modifications of the Rochdale principles. Barton (in Cobia 1989) reports three contemporary cooperative principles:

1. Voting is by member-users on a democratic or proportional basis.

2. Equity is provided by patrons.

3. Net income is distributed to patrons as patronage refunds on a cost basis.

While not included in this set of principles, limited return on equity is implied by the third principle above. In 1987, a further refinement of the principles was summarized by the US Senate-requested study coordinated by the US Department of Agriculture's Agricultural Cooperative Services (USDA-ACS). According to that study, a cooperative is a user-owned, user-controlled, and user benefited agricultural producer organization. More explicitly:

1. The farmer stockholding *owners* are the major *users* of the cooperative.
2. The *benefits* received by the farmer-owner stockholder who contributed equity capital to a cooperative are tied to the concept of *use* of the cooperative in the form of patronage.
3. The *control* of the cooperative by the owner stockholder *user* must be structured democratically in that voting power is not proportional to equity investment although it may be in certain situations structured in proportion to *usage*. Cooperative regulations include the provisions of Subchapter T of the internal revenue service (IRS), the federal tax provision of Section 521, the Capper-Volstead Act for antitrust exemption, the Security Act of 1933, which describes cooperatives' obligations with respect to the initial offer and sale of securities, and state incorporation, antitrust, and securities statues. While a description of these regulations is beyond the scope of this chapter, a general characteristic needs to be highlighted: all require that a cooperative

must "operate on a cooperative basis." Since this has always been interpreted to mean "as a user-owned, user-controlled, and user-benefited firm" (Hardesty 1992a, p. 2), cooperative principles are viewed by IRS and courts as defining the essence of a cooperative and thus whatever impact principles have on property rights, it is institutionalized and further enforced through federal and state regulations. As show in Table 3.1, cooperative principles are directly linked to the four characteristics of cooperative residual claims. The economic implications of these links are also discussed and summarized in Table 3.2.

TABLE 3.1: LINKS BETWEEN COOPERATIVE PRINCIPLES AND RESIDUAL CLAIMS CHARACTERISTICS IN TRADITIONAL US AGRICULTURAL COOPERATIVES

Cooperative Principle	Residual Claim Characteristic	Cooperative
User-Owned	OWNERSHIP	Member-Patrons Only
User-Owned	VALUATION	No Secondary Market to Value Claims
User-Controlled	HORIZON	Valid Only While Patron
User-Controlled	REDEEMABILITY	Partly Redeemable
User-Benefited	TRANSFERABILITY	Generally, not Transferable

TABLE 3.2: COMPARISON OF RESIDUAL CLAIM CHARACTERISTICS BETWEEN IOF AND TRADITIONAL AGRICULTURAL COOPERATIVE			
Residual Claim Characteristic	**IOF**	**Cooperative**	
OWERSHIP	No Restriction	Member-Patrons Only	User-owned
HORIZON	Valid for Life of Firm	Valid Only While Patron	User-controlled
TRANSFERABILITY	Freely Transferable	Generally, not Transferable	User-benefit
VALUATION	Claims Usually Valued in Common Stock Market	No Secondary Market to Value Claims	User-owned
REDEEMABILITY	Not Redeemable	Partly Redeemable	User-controlled

Source: Condon 1990, page 82.

Ownership in Traditional US Agricultural Cooperatives

While the concept of ownership is elusive when complex agglomerations of assets, such as the stock corporation, are considered (Milgrom and Roberts 1992), it becomes even more obscure in the case of cooperatives. Two dimensions of firm ownership must be examined to understand the uniqueness of cooperative organizations: ownership of residual claims, and alignment of residual control and residual claimant rights.

In an IOF, ownership is not restricted to any group of potential investors since anyone who can buy one or more shares of the firm automatically becomes one of its owners. In this way, owners and potential owners can assume the degree of risk they desire by purchasing shares until they have reached their desired level of risk. Additionally, they can diversify their risk of ownership by buying shares in different corporations and thus allocate their resources in the most efficient way. Another benefit of unrestricted ownership in IOFs is that as the number of potential residual claimants grows, the potential pool of equity capital increases as well, thus augmenting the probability of raising funds to purchase organization-specific assets (Condon 1990, p. 81).

In contrast to IOFs, ownership of cooperative residual claims is restricted to the group of patrons or customers of the firm, as a consequence of the adoption of the user-owned principle, resulting in a limited number of potential residual claimants. When finance markets are not perfect,[17] such a restriction may retard the ability of the firm to raise capital for the purchase of organization specific assets (Vitaliano 1983 p. 1080). Additionally, cooperatives are not an attractive investment for non-patrons because their residual income is distributed on the basis of member patronage.

Another implication of restricting ownership to producer-members is the elimination of the transaction costs arising when the firm can behave opportunistically and successfully exploit market power to extract rents from its members. An example of

[17] The term perfect finance markets implies that the cost of debt financing does not increase with the amount of debt employed.

this, is the elimination of transaction costs associated with the measurement of quality when members buy their farm inputs from a cooperative, which is a spatial monopolist. In case farmers were buying from an IOF, they might have to face higher prices for a poorer quality. When, however, they own the firm, they can make sure that the quality of farm inputs supplied by the cooperative is the best possible. Such transaction costs are hypothesized to be low since, in the case of cooperatives, customers and owners are generally the same individuals. However, a disadvantage of the combination of residual claimant and patron roles in the cooperative firm is that it limits the member-patron's opportunity to diversify risk and thus raises the cost of risk bearing.

The second dimension of ownership is the degree to which residual rights of control are aligned with residual claimant rights. When the person who receives the residual return from an asset also has the residual control rights, then decisions regarding the asset will tend to be efficient. If, however, only part of the costs or benefits of a decision accrue to the person making the decision, some of these effects will be ignored, resulting in inefficient decisions (Milgrom and Roberts 1992).

While this proposition cannot always be applied to complex assets and agglomerations of assets, it is useful in understanding potential inefficiencies arising from the misalignment of these two types of property rights. Barzel (1997) argues, that the most efficient allocation of a firm's residual claims is underlined by the simple principle, that the greater a party's inclination to affect the mean income the firm's assets can generate, the greater is the share of the residual claims that party should own. Hart (1995,

pp. 49-55) supplies some evidence from IOFs, illustrating that transaction cost minimizing considerations lead to such an allocation of property rights over the firm's most economically important property rights.

Such alignment of residual control and residual claimant rights is not common in traditional agricultural cooperatives, in violation of the user-controlled and user-financed principles. The simple majority-voting rule of one-member, one-vote, adopted by the majority of US agricultural cooperatives, sometimes results in misalignment of residual control and residual claimant rights. Additionally, federal and state regulations, by not always specifying in detail the voting scheme to be adopted by cooperatives, create a vague institutional environment which reinforces the inefficiencies associated with misalignment of residual control and residual claimant rights.

Another important dimension of the vaguely defined property rights structure in cooperatives is associated with the open membership policy. Cooperatives have traditionally adopted this Rochdale-originated principle, even though it is not included in the USDA definition of a cooperative (USDA 1987). The adoption of an open membership policy may alter individual members' residual claims in unpredictable ways. For example, residual income may be divided between existing and new members and thus, current members who anticipate the potential dilution of their claims are discouraged from investing in their cooperative.

Other restrictions on the ownership of cooperative residual claims are equally important. Centner (1988) explores how statutory provisions that are designed to

promote the user-controlled principle may limit organizational and managerial flexibility. Since, for example, a large number of state statues do not permit proportional voting, a possible misrepresentation of member interests in the board of directors may result in conflicts among the participants in cooperative decision-making.

Restrictions on non-member business (restrictions on residual claim ownership) imposed by Section 521 and the Capper-Volstead Act, designed to promote the user-benefited principle, result in less diversified and thus more risky business investments by cooperatives (Staatz 1987a).

Cooperatives that do not take into consideration the need for proportional voting, closed membership and unlimited returns on capital, create disincentives for their members, with respect to contribution in the long-term growth of the cooperative enterprise (Knutson 1985). These disincentives result from the aforementioned vaguely defined property rights structure, promoted by cooperative principles and regulations.

Transferability of Cooperative Residual Claims

Transferability pertains to the ease with which individuals can transfer their residual claims to others. In the stock market, IOF residual claims are freely transferable to anyone who has the means to purchase them. The significance of the existence of a secondary market (stock market) is difficult to overstate. This secondary market, in its evaluation of the present value of an IOF's residual claims, incorporates all available information about the firm's performance (Fama and Jensen 1983) and thus, under the

assumption of competitive markets, the current price of a firm's residual claims accurately reflects the present and future net income streams generated by the investment decisions of the firm's management (Copeland and Weston 1983). The advantage of such market valuation of residual claims is that individual investors holding these claims can fully capitalize the present value of future income streams at any time by selling the claims or by borrowing on its market established value (Vitaliano 1983).

Additionally, the existence of a secondary market operates as a management control mechanism (Jensen and Meckling 1976). Management's decisions, investment or otherwise, are valued by the market and the price of residual claims (stock prices) fluctuates according to this valuation. Consequently, when an IOF manager makes decisions that increase the future value of the company, this is reflected in its increased market price with positive consequences for the manager, while the opposite is true when management makes decisions that lead to the detriment of the company.

In traditional US agricultural cooperatives state statues, articles of incorporation, or cooperative bylaws, almost always prohibit transferability of residual claims. Additionally, most states explicitly prohibit proportional voting, even if members are allowed to own more than one shares (Reynolds et al. 1997). This creates a disincentive to invest in the cooperative, since members do not control their cooperative investment in proportion to the amount they have invested. As the user-benefited principle implies, members earn residual returns based on patronage with the cooperative, not their investments.

This non-transferability feature of cooperative residual claims prevents the existence of a secondary market to trade and value these claims, with a resultant loss of an important control characteristic on management behavior (Condon argues 1990 p. 86). The truth of this argument has been questioned in recent theoretical work by Hansmann (1996), who argues that members of agricultural cooperatives are in a very good position to monitor cooperative management effectively because they have both the incentive and the opportunity to do so. The incentive for effective monitoring in the case of marketing cooperatives comes from the fact that the crops that cooperatives market represent a major, and often the only, source of income for the farmer-members.

Moreover, farmer-members have the opportunity to exercise management control by the very nature of the cooperative governance structures. The high degree of control that members are able to exercise is reflected in the composition of their boards of directors which, in contrast to IOF boards, consist almost exclusively of members who are active producers. Hence, agency costs for cooperatives are, "from all evidence available, unusually small in these organizations" (Hansmann 1996, p. 134).

If Hansmann's view is accepted, the absence of a secondary market for valuation and transfer of cooperative residual claims may not increase agency costs in cooperatives by as much as asserted by other economists (Condon 1990; Vitaliano 1983; Porter and Scully 1987). Cook (1995) maintains that agency costs are not the same for all types of cooperatives. While they are relatively insignificant in single commodity Sapiro II and Sapiro III cooperatives, they tend to be higher in Nourse I and Nourse II, especially when

they are highly diversified firms, and thus monitoring of managerial decisions is extremely incomplete. However, empirical investigation of this issue is necessary before any definite conclusions could be drawn.

Redeemability of Cooperative Residual Claims

Redeemability is the ability owners of a firm's residual claims have, to sell these claims to the firm, at an *ex ante* agreed upon price. This transaction is different from the market transaction where the owner of claims to the firm's residual income sells these claims to another individual. In the first case, the sold residual claims carry only the accrued value of the claims to that date, while in the latter they also carry the earning potential in the future (Condon 1990, p. 87). Complete redeemability of residual claims acts as a partial takeover threat to management and thus could be a management control mechanism in the hands of the firm's residual claimants. By removing assets from the control of management, redeemability of equity capital disciplines management to act to the best interests of residual claimants (Vitaliano 1983, 1985).

IOF residual claims are redeemable only in special situations such as a change in ownership form from public to private. However, it has been argued that the existence of a secondary market for IOF residual claims more than compensates for the absent redeemability feature of IOF residual claims (e.g., Fama and Jensen, 1983b; Condon, 1990).

Cooperative residual claims can be redeemed to a limited degree. Usually, a member can demand her portion of equity capital, plus any accrued interest, only when she leaves the cooperative. Yet, members are paid their allocated equity[18] back, only after some revolving period, the length of which is at the discretion of the cooperative board of directors, and in many cases it is very long (Cobia 1989).

Member-patrons have some options in dealing with such issues. First, they can vote to dissolve the organization and distribute its assets. For individual members, another option is to exit the cooperative and patronize another organization, given that other firms operate in some geographical proximity. Additional alternatives include voting for a merger of the cooperative with another cooperative, or conversion to an IOF. All these options act as management-disciplining mechanisms but they are not as effective as a secondary market for cooperative residual claims (Condon 1987).

Time Horizon of Cooperative Residual Claims

The time horizon of a firm's residual claims refers to the length of period that these claims are valid. The term of validity is an important characteristic of residual claims, because it may or may not enable a firm's residual claimants to capture the full value of their investment in the firm. According to the Fisher Separation Theorem, when there are perfect capital markets[19], the decision of a firm's owners whether to invest will depend

[18] Allocated equity is built in the cooperative mainly through retained patronage refunds, per-unit capital retains, and direct member investment-to a lesser extent (Cobia and Brewer in Cobia 1989, p. 247).
[19] The term perfect capital markets implies that all parties, whether they are buying or selling, transact at the same terms and these terms are unaffected by the amounts any one party transacts.

only on the returns they forecast from the investment and on the interest rate and not on their preferences regarding personal consumption or its timing. The term separation in the name of the theorem reflects the conclusion that an owner can separate the decision about whether to invest from the decision about how to arrange consumption over time (Milgrom and Roberts 1992, p. 450).

The Fisher Separation Theorem is very important for the analysis of firm investment decisions. When considered in combination with the transferability and appreciability features of IOF residual claims, it can shed light on investment decisions by individual owners. For example, suppose that an owner of an IOF is near retirement and wants to start consuming some wealth she has accumulated over a lifetime. According to the Fisher Separation Theorem, she has no reason to vote down a new profitable investment, provided the investment can be financed with loan proceeds, since she can capture the increased future value of the firm as a result of the investment in the stock market.

On the other hand, time horizon for cooperative residual claims is restricted by the very fact that residual claims in cooperatives are earned through, and in proportion to, patronage of the firm, due to the user-owned, user-controlled, and user-benefited principles. Thus, when a member no longer patronizes the cooperative (e.g., when she retires), she cannot capture in subsequent periods, returns from investments that will be realized after her exit from the cooperative. In combination with the fact that cooperative residual claims are non-transferable and non-marketable in a secondary market, their

limited time horizon makes almost impossible for a member to capitalize the present value of future income streams generated by existing investments. As a result, members' discount rate for investments with future income streams extending beyond a member's expected horizon is zero (Vitaliano 1983). Consequently, those members who plan to stop patronizing the cooperative before these investments start generating income will turn down proposed profitable investments. A continuum of investment preferences for cooperative members can be hypothesized to exist: if a member is five years from retirement she would be less willing to vote for an investment than a member with a fifteen years membership horizon.

Related to the limited time horizon of cooperative residual claims is the problem of debt financing. Staatz (1987a) and Vitaliano (1983) argue that cooperatives may lack adequate sources of debt financing because some lenders consider cooperative equity to be insufficiently permanent. What these lenders fear is that, due to the horizon constraint, current members will tend to maximize their short-term benefits derived from the cooperative and thus, will not be able to repay their long-term debt.

The above restrictions on the ownership, transferability, redeemability, and effective time horizon of cooperative residual claims, foster the vaguely defined property rights structure observed in traditional agricultural cooperatives. The major inefficiencies arising from this structure are categorized into five problems: the free rider, the horizon, the portfolio, the control, and the influence costs problems (Cook 1995). These constraints can be usefully categorized into two generic sets: investment constraints (free

rider, horizon, and portfolio constraints) and collective decision-making constraints (control and influence costs constraint).

Investment Property Rights Constraints in US Agricultural Cooperatives

The Free Rider Constraint

It has long been recognized in the economic literature that groups of people organized to further their interests must solve several problems inherent in collective action. Among these problems, the most frequently discussed and analyzed is the free rider problem. It refers to situations where a person cannot be excluded from the benefits that others provide and thus, each person is motivated to avoid contributing to the joint effort; it is said that this person free-rides on the efforts of others (Ostrom 1990).

The problems of collective action and commonly owned property, have been identified since Aristotle, who maintained that "what is common to the greatest number has the least care bestowed upon it" (Politics, Book II, Chapter 3). During the last four decades, the three most influential models analyzing aspects of the free rider problem have been (i) the tragedy of the commons (e.g., Hardin 1968), (ii) the prisoner's dilemma, and (iii) the logic of collective action (Olson 1965). It is this last model that is utilized in the following sections to study the free rider constraint in agricultural cooperatives.

Various aspects of the free rider problem in agricultural cooperatives have been identified during the last forty years (e.g., Helmberger and Hoos 1962; Rhodes 1978; Staatz 1987d, 1987b, 1987a; Condon 1990; Vitaliano 1978, 1983; Cook 1995; Hetherington 1991; Hansmann 1996). However, while most aspects of the problem have been identified, empirical tests of a series of sporadically presented hypotheses, are largely missing.

Collective Action, Agricultural Cooperatives, and the Free Rider Constraint

The free rider constraint in cooperatives can be of two types: the external free rider and the internal free rider constraints (Cook 1995). The external free rider problem refers to the situation where a non-member receives benefits associated with the provision of public goods by the cooperative, but avoids becoming a member and thus eschews contributing to the costs of this provision which are incurred by the members alone. A closely related problem occurs when a member of a cooperative temporarily stops patronizing the cooperative when she finds it to her best short run interest. An example of this would be the member of a fruit canning cooperative who sells her produce to an IOF during years of high prices, but turns to the cooperative when overproduction lowers prices.

The internal free rider constraint hints at a common-property problem which occurs when newly entering producers are entitled to the same payment per unit of patronage as existing members and thus receive, in part, a return on an investment for

which they did not contribute equity. In the absence of active compensation by new to existing members, a clear disincentive is created for existing members to invest equity capital in the cooperative (Condon 1990).

The External Free Rider Constraint

The external free rider constraint is probably the most discussed issue in collective action, at both the theoretical and practical levels. Most of the collective goods provided by traditional agricultural cooperatives in US are characterized by de facto unfeasibility of exclusion; it is impossible to prevent nonmembers from consuming them, or in Olson's words (p.14), " they must be available to everyone if they are available to anyone." Such collective goods include not only goods in the physical sense, but also the achievement of any common goal or the satisfaction of any common interest. Olson defines a public good as a 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[20].

An example of a collective good characterized by unfeasibility of exclusion, is the higher price for a commodity, tomato say, which a Sapiro I bargaining cooperative achieves. Producers in the area where the bargaining association operates do not have to be members in order to enjoy the higher tomato price and thus can get some important benefits[21] resulting from the operation of a cooperative in their area without investing in it.

[20] For more on the definition of collective goods, see Olson (1971, p.14, footnote 21)
[21] Both pecuniary and non-pecuniary.

In some cases, due to this free rider constraint, the collective good may not be provided at all, even if its provision is to benefit all interested individuals. Furthermore, as has been shown in the collective action literature (e.g., Olson 1965; Hardin 1982), even if existing members invest enough in their cooperative so that the collective good is provided, this provision will be at a suboptimal[22] level. In his seminal work, Olson presents the reasons behind this suboptimal provision of collective goods by categorizing groups along several dimensions. First, he distinguishes between groups that make exchanges at monetary values determined by supply and demand (market groups, or market situations), and those that do not (non-market groups, or situations). Second, Olson categorizes groups as "Exclusive," or "Inclusive." Exclusive groups want to keep new members out and perhaps even eliminate some of the existing ones. For example, in an industry[23], a firm wants to keep new firms from coming in to share the market, and force as many as possible of those firms already in the industry to exit. Inclusive groups attempt to attract new members, while making sure not to lose old ones. A bargaining association is an example where bargaining power is proportional to the number of its members.

Finally, Olson identifies three types of groups with respect to size: the group of one, the small group, and the large group. Incentives facing the members of each group

[22] Suboptimal here implies that the good is provided at a level lower than that, which would maximize the benefit of the cooperative membership as a whole.

[23] "Industry" here, implies a group, which seeks to increase the collective good "total industry profits." Of course, each firm within the industry wants to capture as much of these profits as possible for itself. The ideal for each firm would be a monopoly.

differ, depending on the size of the group, the degree of interest that specific group members have for the collective good, and how noticeable individual contributions within the group are. For example, an individual member of the group may value the benefits she enjoys from the provision of the collective good so much that she decides to provide it by herself, even if it is known that the rest of the group members free-ride on her effort.

Noticeability of individual contributions is also important in Olson's framework and refers to whether the contribution or lack of contribution by an individual has a noticeable effect on the costs or the benefits of others in the group. When noticeability is low, each group member has an incentive to free ride on the efforts of others in the group. In general, the larger the group, the less noticeable individual contributions are. However, even in small groups noticeability can be low, as a result of the characteristics of the collective good. An example of this situation is a small group of employees in a company performing a task the result of which cannot be attributed to any individual member. In other words, it is not only the absolute size of a group that determines the level at which a collective good is provided but its other characteristics as well.

The "group of one" faces no public good problem. In market situations it refers to a monopolist or a monopsonist, while in non-market situations it refers to the single individual outside the market seeking some non-collective good without external economies or diseconomies.

The "small group" refers to an oligopolistic industry where strategic interaction between the members of the group determines whether the collective good will be

provided and at which level. In non-market situations, two types of small groups are identified: the privileged and the intermediate groups.

The "privileged group" is such that each of its members, or at least some of them have an incentive to see that the collective good is provided, even if he has to bear the full burden of providing it himself. A group of this description is likely to exist where beneficiaries are unequal in size and/or interest in the collective good. Even in privileged groups however, there is a tendency for 'exploitation' of the great by the small. Since the large members will provide the good anyway, small members avoid sharing even a slight share of the costs.

Even groups where the collective good is provided, there is a tendency towards suboptimal provision, due to the fact that a collective good is, by definition, such that other individuals in the group cannot be kept from consuming it once any individual in the group has provided it for himself. Additionally, the amounts of the collective good that a member of the group receives free from other members will further reduce her incentive to provide more of that good at her own expense (Olson 1971).

Because the small member opts to ride free on the provision made by the large, all members have to accept a smaller quantity of the collective good than they would ideally preferred, while each taken in isolation is tolerably satisfied (the large member) or more than satisfied (the small). Suboptimal it may be, but some supply is indeed forthcoming in the case of the "privileged" group.

This may not be the case for the "intermediate group" which is such that no single member gets a share of the benefit sufficient to give him an incentive to provide the good herself, but it does not have so many members non-contribution by a member will go unnoticed. The situation here is one of radical uncertainty as to the reactions of others, strategic interaction becomes the rule of the day, the theory of games becomes paramount, and there is no way of predicting how much (if any) of the public good will be provided.

The large group refers to the perfectly competitive industry with its analog in a non-market situation being the "Latent group." An individual in a "latent group," cannot make a noticeable contribution to any group effort and, since no one in the group will react if he makes no contribution, he has no incentive to contribute. Consequently, large or "latent" groups will not act to obtain a collective good[24] because no individual incentives exist for contributing to the latent group's interest, or to bear in any other way any of the costs of the collective action.

Members of such a latent group can only be stimulated to contribute to the common goal by means of selective incentives, or by coercion. A latent group that has been led to act in its group interest, either because of coercion of the individuals in the group or because of positive rewards to individual members, is called a "mobilized' latent group. Large groups are thus called "latent" groups because they have a latent power or capacity for action, but that potential power can be realized or "mobilized" only with the

[24] Even if it is highly valuable to the group as a whole.

aid of selective incentives. The factors that keep large groups from furthering their own interests are three:

(1) The larger the group, the smaller the fraction of the total group benefit any person acting in the group interest receives, and the less adequate the reward for any group-oriented action, and the farther the group falls short of obtaining an optimal supply of the collective good, even if it should receive some.

(2) The larger the group, the more it resembles a perfectly competitive situation, and thus the smaller the likelihood of oligopolostic interaction that might help obtain the good[25].

(3) The larger the number of members in the group the greater the organization costs, and thus the higher the hurdle that must be jumped before any of the collective good at all can be provided.

Utilizing Olson's group typology, in Figure 3.1, Sapiro and Nourse[26] cooperatives are placed along the dimensions of exclusivity-inclusivity, and size and noticeability. It is not only the absolute group size that determines whether the collective good is

[25] By oligopolistic interaction, Olson refers to the interaction between members of an intermediate-sized group. In such group, a single individual or a subgroup of members might still provide the collective good. What determines, in this case, whether the good will be provided is not only the benefit of the individual (or the group) but, also, whether her contribution to the group objective has a noticeable effect on the costs or benefits of others in the group.

[26] According to a more general taxonomy developed by Cook (1993), US agricultural cooperatives belong to one of the following types: (1) Nourse I, local multi-purpose cooperatives; (2) Nourse II, regional multi-purpose cooperatives; (3) Sapiro I, bargaining associations; (4) Sapiro II, marketing cooperatives; and (5) Sapiro III, new generation cooperatives. Nourse cooperatives epitomize the Nourse philosophy of collective action in agriculture—that of a "competitive yardstick" with the objective to keep IOFs competitive. Sapiro-inspired cooperatives aim mainly at increasing market margins and avoiding market power when dealing with proprietary handlers.

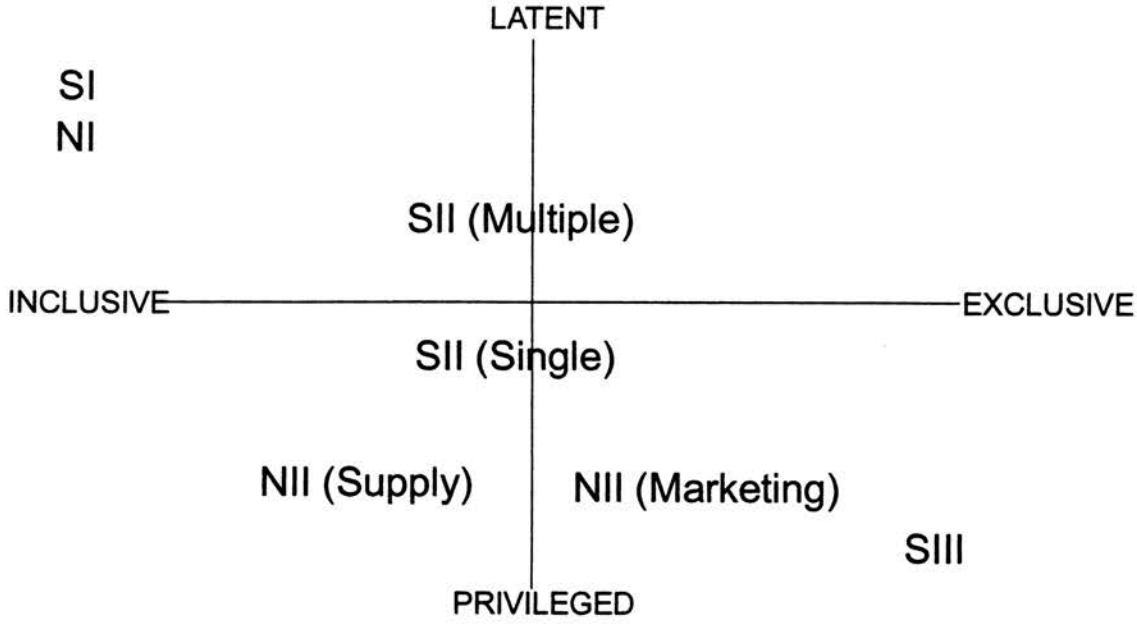
provided,[27] because the combination of size and noticeability plays the most important role. Thus, the vertical axis ranges from small, privileged, groups where the provision of the public good is certain, to latent (large) groups where only selective incentives would ensure the provision of the good.

The horizontal axis measures the degree of inclusivity characterizing each group and ranges from "Inclusive" to "Exclusive" groups. While inclusive cooperatives want to attract new members and maintain their current membership, exclusive cooperatives want to maintain their current membership[28] but do not accept new members.

Sapiro I and Nourse I cooperatives are placed in the upper left corner of the diagram, indicating that for both of them the free rider constraint is a major problem because, in their case, the collective good is either a higher product price or a lower input price. For both of these types of cooperatives, increasing their membership entails stronger bargaining position, which lends itself to more efficient provision of the public good. Therefore, the major collective good for NI and SI cooperatives are such that they transform themselves into inclusive groups. Additionally, as membership increases in both local and bargaining cooperatives, each member's actions become less and less noticeable to other members, which also creates a disincentive for members and potential members to invest in the cooperative.

[27] An if it is provided, at which level (optimal or sub-optimal).
[28] Notice that here the term "exclusive group" is used in a slightly different way than that proposed by Olson. This is mainly because it is difficult, if not impossible, to find cooperatives that would want to force some of their current members to leave the cooperative.

Figure 3.1: Categorization of US Nourse and Sapiro Cooperatives Using Olson's Typology of Groups



Nourse II, multi-purpose regional cooperatives are divided into two subgroups: those focusing mostly on the supply of inputs to their members, and those focusing on marketing their members' products. On the supply side, Nourse II cooperatives are placed in the lower left part of the diagram because their bargaining position is strengthened as membership increases and thus, the nature of the collective good they provide makes them inclusive. However, they will accept new members only until all economies of scale in the provision of the good have been exhausted. Additionally, the

federated structure and/or the high degree of noticeability of each member's actions, place supply oriented Nourse II's in a "privileged group" position.

On the marketing side, Nourse II's are also placed at the same point as supply-focused NOURSE II cooperatives, with respect to the vertical axis. However, in their case, the collective good is such that they become exclusive after some point, due to diseconomies of scale in the processing and/or handling of the raw product.

Another important aspect of Nourse II's is that the suboptimality in the provision of a collective good characterizing large groups[29] may be minimized when these groups constitute federations of smaller sub-groups which can use selective --social--incentives to force their members to contribute to the common interest (Olson 1971). Therefore, large federated Nourse II cooperatives may overcome the external free rider constraint more easily than large centralized cooperatives.

Sapiro II, marketing cooperatives are also divided into two sub-categories: cooperatives marketing a single commodity and those marketing multiple commodities. Single-commodity marketing cooperatives are placed on the middle of the vertical axis (inclusive-exclusive groups), since their choice of membership policy depends upon considerations regarding both economies and diseconomies of scale and the possibility of overproduction during a specific year.

The same is true for Sapiro II's marketing multiple commodities. The major difference between these two types of Sapiro II cooperatives, with respect to size and

[29] Again here, large groups are defined both in terms of size, but most importantly in terms of how visible the contributions of individual members to the common interest are.

noticeability, is that multiple-commodity cooperatives are more apt to develop characteristics of a large group, when the various groups of producers are relatively equal in size and have conflicting interests. In large, multiple-commodity marketing cooperatives some of the collective goods may provide benefits only to a particular subgroup of members and thus members who do not receive benefits from the provision of the collective good will not contribute to this provision, unless there is coercion or some outside inducements. Given a one-member, one-vote system, however, the collective good might still be provided if a large enough number of members receive benefits from the provision of the good.

Finally, Sapiro III, new generation cooperatives are placed in the lower right corner of the diagram, indicating that for this type of cooperative exclusivity, and size and noticeability are high. The collective goods provided by Sapiro III cooperatives are: a higher raw and final (value-added) product prices and a share in the increased value of the cooperative firm. Both are exclusive in nature after the minimum efficient scale (MES) has been reached. Additionally, the number of members is generally small in new generation cooperatives and thus, individual members' contributions are highly visible. These characteristics are assumed to lead to the amelioration of the external free rider constraint in Sapiro III cooperatives.

The Internal Free Rider Constraint

The internal free rider constraint results from the fact that in traditional agricultural cooperatives the rights to the residual claims are not aligned with the residual rights of control over cooperative assets but, rather they are tied to the right of patronizing the cooperative. This results in a common-property problem, where newly entering members who obtain patronage and residual rights in a cooperative are entitled to the same payment per unit of patronage as existing members[30] (Vitaliano 1983). When new members receive the same return as existing members, they are receiving in part, a return on an investment for which they did not contribute equity, as a result of which the rate of return existing members expect to receive for their investment in the cooperative is significantly diluted. Anticipating this dilution, current members will be reluctant to invest equity in the cooperative at levels that will result in a payment high enough to attract new members (Condon 1990, p. 97).

The two factors that determine the intensity of the internal free rider constraint are the adopted membership policy (Condon 1990, p. 97; Staatz 1987a, p. 41; Vitaliano 1983, p. 1081; Porter and Scully 1987, p. 496) and the lack of a secondary market for cooperative residual claims (Condon 1990, p. 97; Vitaliano 1983, p. 1081; Cook 1995, p.1155)

When a successful cooperative adopts an open membership policy, it is like inviting non-member producers to join and share the success of the cooperative with

[30] Under the assumption of course that economic behavior is the driving impetus in US agricultural cooperatives.

existing members, even though they have not contributed to this success. Then, why do most traditional cooperatives still maintain an open-membership policy? And further, why do some cooperatives switch back and forth from an open to a restricted membership structure? Historical explanations[31] may be helpful in answering such questions. Additionally, the internal free rider problem is expected to create differences in the preferences of various members based upon the length of time their claims have been held, "with a general tendency for them to favor decisions that increase organizational cash flows per member" (Vitaliano 1983, p. 1081). These diverse preferences may explain why some cooperatives adopt a restricted-membership policy when the effects of decisions can be fully captured in a cooperative's cash flows (e.g., through the sale of a differentiated product), and why cooperatives try to expand their membership when this is not the case.

The same argument holds in the case of cooperatives charging new members substantial entry fees, and/or using various base capital plans. Substantial entry fees for newly entering members act as a partial compensation by new to existing members (Condon 1990, p. 97). Moreover, base capital plans promote proportional financing of the cooperative, and thus act in the same way. Hansmann (1996, p. 154), incorporating the same line of reasoning, argues that cooperatives which charge different membership fees per member (the charge depending on some fixed asset, e.g., acreage) can be expected to have higher investment per member.

[31] For example, the argument can be made, that open membership has been a cooperative tradition since the establishment of the Rochdale Society, or even earlier.

The other important factor that intensifies the negative impact of the internal free rider constraint is the lack of a market for establishing a price for cooperative residual claims. If such a market existed, the price of residual claims would reflect both the accrued and present value equivalent of their future earning potential (Condon 1990, p. 97). Subsequently, producers entering the cooperative would have to buy such ownership rights at the market-established price from existing members, thus allowing them to capture the value of their investment and hence minimize their disincentive to invest in the cooperative. Cooperatives which, in the absence of such market, provide the same payment per unit of patronage for existing and newly entering members, should be expected to have lower investment per member that those that do not (Cook 1995, p. 1155).

The Horizon Constraint

The horizon constraint was first discussed in the context of labor-managed firms (Jensen and Meckling 1979; Pejovich 1979). In such organizations, as in cooperatives, the residual claims are contingent rights to the net income of the firm, which are valid only as long as their owners patronize the organization. This has several important implications for both organizational structure and performance, which lend themselves to labor-managed as well as cooperative firms.

With respect to the latter, the horizon constraint is defined as the creation of an investment environment in which cooperative members have a disincentive to contribute

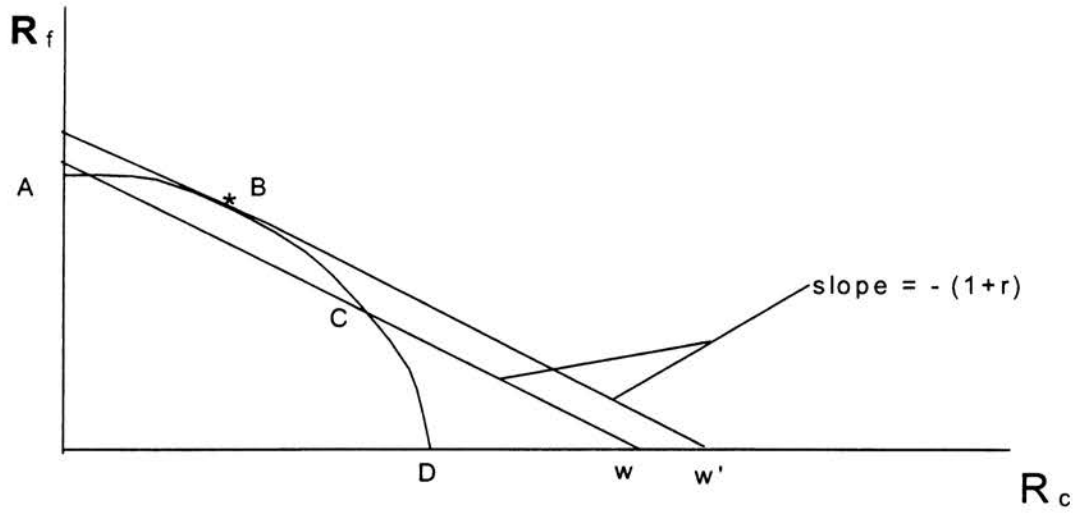
to growth opportunities. Such environment is created whenever a member's residual claim on the net income generated by a cooperative asset, is shorter than the productive life of that asset (Porter and Scully 1987).

It is restrictions on transferability of residual claimant rights and the lack of liquidity through a secondary market for the transfer of such rights that give rise to the horizon problem, which becomes more serious when considering investments in intangible assets. It manifests itself by pressure on the Board of Directors and management to increase the proportion of the cooperative's cash flow devoted to current payments to members relative to investment and accelerate equity redemption at the expense of retained earnings (Cook 1995). While most of the aspects of the horizon constraint have already been discussed in the literature, a detailed synthesis of these aspects and an empirical investigation of the various theoretical hypotheses are largely missing.

Cooperative Long-term Investments and the Horizon Constraint

Utilizing the framework proposed by Vitaliano (1985), a more detailed analysis of the constraint follows. To better understand the horizon problem, it is supposed that a cooperative face investment-opportunity set ABCD in Figure 3.2, below.

Figure 3.2. Horizon Problem -- I



The horizontal axis (R_c-axis) measures resources available currently, while the vertical axis (R_f -axis) measures resources available in the future. These resources are standardized on a per-member basis. The question to be addressed is "what is the optimal level of investment in the (R_c, R_f) space?"

Initially, it is assumed that all cooperative members have identical utility functions $U_i(C_c, C_f)$, where,

C_c = Consumption currently, and

C_f = Consumption in the future.

Therefore, the task of the manager of the cooperative firm is to:

$$\max \sum_{i=1} \alpha_i^t U_i\left(C_c, C_f\right)$$

$$\text{subject to } \sum_{i=1}^{I} C_c + \frac{1}{1+r} \sum_{i=1}^{I} C_f = \sum_{i=1}^{I} w_i$$

$$\text{where, } \sum_{i=1}^{I} w_i \equiv R_c + \frac{1}{1+r} R_f$$

and, w_i is the wealth available to member i, and r is the market interest rate.

Since the manager has some choice about R_c and R_f (and hence W), the investment decision, amounts to choosing that (R_c, R_f) from the set of investment opportunities which maximizes wealth (W), given the value of interest rate (r). It is further assumed that the two-period investment opportunity set is a convex, negatively sloped line such as ABCD in Figure 3.2. Alternatively,

$$R_f = f(R_c)$$

$$\text{with } \frac{df}{dR_c} \prec 0$$

$$\text{and } \frac{d^2 f}{dR_c^2} \prec 0.$$

Then, when cooperative membership is taken as a whole, its investment decision is to choose R_c (and hence R_f) to maximize:

$$W = R_c + \frac{1}{1+r} R_f = R_c + \frac{1}{1+r} f(R_c)$$

The First Order Condition for this problem is:

$$\frac{dW}{dR_c} = 1 + \frac{1}{1+r} f'(R_c) = 0$$

$$\text{or, } f'(R_c) = -(1+r) \qquad (1)$$

Geometrically, (1) says that the optimum pair (R_c^*, R_f^*) is such that the slope of the investment-opportunity set is equal to - (1+r).

In figure 3.2 the optimum is at point B. The present value of wealth associated with any point in the (R_c, R_f) space can be found by drawing a straight line with slope -(1+r) through the point. The intercept of this line along the R_c-axis is the present value of the associated point. Any point such as C on the investment-opportunity line will have a smaller present value than point B (for example, $W < W'$).

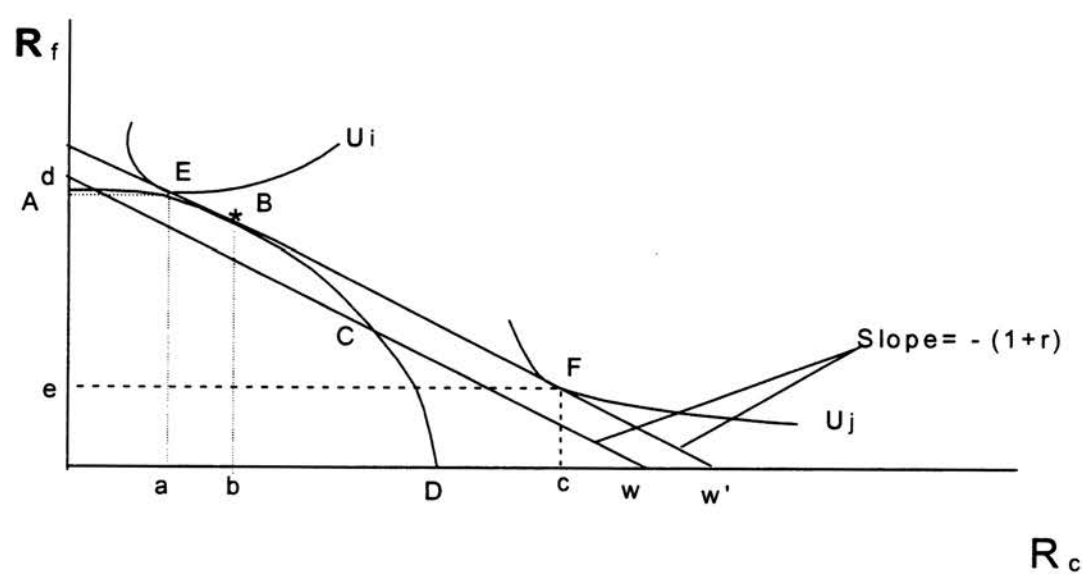
Different Utility Functions

How does the analysis presented above change when members have different utility functions? In the derivation of the optimal investment decision, no reference was made to any specific utility functions since the optimal investment was easily ascertained by knowledge of only the interest rate (r) while information on individual utility functions was not required. This followed from being able to separate the investment and consumption decisions. This is the separability property, which postulates that a manager can choose investments for a cooperative without knowing the specific utility function of each member because the specific pattern of the dividend stream is irrelevant to the stockholders if they can lend or borrow at the market interest rate r. All that is relevant, is the present value of the dividend stream.

The separability property is invalid if one or all of the following conditions hold: (1) claims to residual cash flows are not marketable/transferable, (2) the interest rate for borrowing is not the same as the lending rate, and (3) the firm is not a price taker with respect to the interest rate.

It is now assumed that claims (held by members) to the residual cash flows of the cooperative are marketable/transferable and that none of the above conditions holds. It is also assumed that members have different utility functions. For simplicity, the case considered here is that of a cooperative with two groups of members i. Members within a group have identical utility functions, while utility functions between groups are allowed to be different[32]. Ui and Uj denote the utility functions of the two groups and the situation is depicted in Figure 3.3, which is a reproduction of Figure 3.2.

Figure 3.3. Horizon Problem--I I



The investment strategy that maximizes the utility of all members corresponds to point B on the investment-opportunity set, regardless of the individual time preferences of the two groups of members. A member (or a group of members) with utility function U_i which

[32] Extending the analysis to more than one utility groups would only complicate matters; and it would not enrich the derived results in any significant way .

reveals the preference of the group (or member) for less consumption today and more in the future, can lend her uninvested portion of current period resources (e.g., distance ab in Figure 3.3) at market rate r and thus achieve a utility maximum at point E. Another group of members, with utility function U_j, which reveals preferences skewed toward the present, can invest in the cooperative which invests at point B and then sell, or borrow against, the resulting claims and thus achieve a utility maximum at point F. In this way, all members maximize their utility when the cooperative pursues the investment strategy given by the first order condition (F.O.C.) derived in the previous section[33]:

$$f'(R_c) = -(1+r)$$

As a result, this strategy will be supported by all members and will result in maximum present value of the cooperative firm's future cash flows, illustrated by point W'. However, if the assumption of marketable claims is relaxed, the above result no longer holds. Vitaliano (1985, p. 68) noted:

> "... in a cooperative, those claims cannot be marketed, and hence members with time preferences skewed toward the present cannot realize as great a level of utility with a cooperative investment strategy that maximizes the present value of future cash flows as they can with some strategy involving lower investment of current resources and correspondingly lower future payoffs. These members, who would include members planning to cease patronizing the cooperative before all returns to a particular investment could be realized as well as members with individual cash flow constraints, such as newly established farmers, would influence the cooperative's investment strategy to the point

[33] When the Cooperative investment corresponds to point B (given by the F.O.C.), returns to the membership as a whole are maximized. Then, given transferability of residual claims, members achieve their highest individual utility by being able to maximize their returns, subject to their individual risk preferences.

where one such as that corresponding to the point C, with lower present value than strategy B, ($W < W'$) might be chosen instead."

The implications of the horizon constraint for the investment behavior of cooperative firms stem from the fact that residual claimants can capture the benefits of investment decisions only as long as they patronize the cooperative. When a member retires, she typically receives the original face value of any outstanding equity capital she has invested in the cooperative. Since members capture economic gains only from the firm through patronage, the member may be reluctant to make investments whose income stream may be realized after she has stopped patronizing the cooperative.

The restricted horizon of cooperative residual claims is expected to result in different subgroup member utility functions, based on how long they expect to patronize the cooperative (Vitaliano 1983, p. 1082). The net result can be expected to be either under-investment, relative to firms whose residual claims are not restricted, or support of investment portfolios skewed toward shorter-term projects (Condon 1987, p. 26). Additionally, it has been shown that the portfolio of investments adopted by a firm whose residual claims are limited in horizon, will not be optimal relative to firms whose claims have infinite horizon (Fama 1980).

Several authors maintain that the use of equity redemption plans by many cooperatives can be viewed as an attempt to ameliorate the horizon constraint (e.g., Condon 1990; Staatz 1987a; Porter and Sully 1987). Other researchers argue that while equity redemption plans ameliorate the horizon constraint with respect to investments that

pay off during the same period their costs are incurred, they fail to do so for other types of investments[34] (e.g., van Wassenaer 1989).

Staatz (1987d) gives a relatively extensive, non-technical description of the horizon constraint which may be manifested in the behavior of members who pressure management to:

1. increase the proportion of the cooperative's cash flows devoted to current payment to members, relative to investment;
2. speed up equity retirement programs and increase the dividend paid on equity capital invested in the organization, both at the expense of retained earnings; and
3. avoid the liquidation of cooperative assets (Staatz 1987d, p. 45).

With respect to the last manifestation of the horizon constraint, it is also noted that pressures to liquidate cooperative assets in whole (as opposed to part of them) may not be exerted. This is because in most states the incorporation statutes specify that in case of total liquidation, a cooperative's assets must be distributed among past as well as current members and thus current members will not find it to their best interest to pressure for such liquidation.

Another aspect of the horizon constraint[35] refers to a general tendency by cooperatives to borrow under conditions that place the repayment burden on future generations (Staatz 1987d, p. 45). Since some types of debt have to be repaid in a period longer than the expected membership horizon of most members, they are preferred to

[34] An example would be intangible assets.
[35] And, also, another way in which it may be manifested

short- or intermediate-term borrowing. For example, one should expect to observe issuance of long-term bonds with low coupons and no sinking-fund provisions.

Another important implication of the horizon constraint refers to the reluctance of cooperative members to invest in intangible assets (Porter and Scully 1987, p. 495; Cook 1995, p. 1156). Investments in intangible assets are typically characterized by income streams realized many years after the initial investment has been made. Since cooperative residual claims are not transferable and appreciable, current members do not have the means to capture the future increase in the cooperative's value resulting from an investment in intangible assets. Examples of investments in intangible assets include advertising campaigns, brand name loyalty, and executive and member education.

However, the above argument should not be taken to imply that the horizon constraint is related only to investment in intangible assets because investment in tangible assets may also be problematic. In conclusion, the three conditions that need to be met for the horizon constraint to be a serious problem are that: (1) the expected payback horizon of an investment is longer than the expected membership horizon of the majority of members[36], (2) restrictions exist on the transferability of cooperative residual claims, and (3) there is no established secondary market for the transfer of those claims. These conditions can hold for investments in both physical and intangible assets.

Another issue frequently discussed in the cooperative economics literature, are the conditions under which the horizon constraint would be possibly ameliorated. As

[36] It is assumed that this majority is represented by Board members elected on a one-member, one-vote basis, rather than by a proportional voting scheme.

previously argued, the horizon constraint is caused by restrictions on the transferability of residual claims and the lack of a secondary market for the transfer of such rights. If cooperative residual claims are transferable and an effective market for the exchange of such claims exists, the problem is ameliorated at least to some extent, determined by the degree of liquidity that such transferability offers and the absence of market failures in the respective market.

Additionally, educating members on the specifics of the horizon constraint and the resulting investment inefficiencies has been suggested as a way to ameliorate the problem (Condon 1987, p. 26) but, since education represents an intangible asset, members may be reluctant to accept it. The horizon constraint is also ameliorated if the present value of long-term investments is capitalized into the value of some fixed asset, such as a farm, under the presumption that cooperative membership can be bought and sold with this asset (Condon 1987, p. 26). One way that such effective salability of membership could be achieved is when the farm is incorporated and the corporation, rather than the person who owns it, is the member of the cooperative (Staatz 1987d, p. 45).

A related solution is provided when production contracts between a marketing cooperative and its members are tradable, and as a result the price of such contracts would reflect the present value of cooperative investments (Condon 1990, p. 98; Staatz 1987d, p. 45). Another proposed solution, in the case membership cannot be transferred,

is a completely open membership policy because, then, the value of the cooperative would be fully capitalized into the value of the farm (Staatz 1987d, p. 45).

On the other hand, Staatz argues that in case membership is not fully open but the probability of gaining membership if one buys the farm of a member is increased, then the discounted value of the cooperative's future earnings will be partially captured into the farm's value. However, if competition with IOFs leads to higher farm product or lower input prices in the area, then an external free rider problem emerges, as the present value of the cooperative's future activities are partially capitalized into the value of both members' and non-members' farms. This unsolicited result may be taken as an indication that the aforementioned solutions are mainly static in nature, since they do not recognize some longer-term side effects.

Another instance where the horizon constraint may be overcome is when farmers can pass cooperative membership to succeeding generations and they perceive utility in doing so (Condon 1987, p. 26). Additionally, member relations programs or other similar initiating programs may play an important role in the amelioration of the horizon constraint, to the extent that such socialization programs can induce members to take a longer-term view of the cooperative and its investments. Such programs however, are more likely to be successful in small cooperatives than in large diversified ones with highly heterogeneous membership (Staatz 1987d, p. 46).

Fulton (1995) is relatively pessimistic in arguing that the contemporary prevailing culture is one of individualism, and therefore such solutions are not applicable in today's

cooperatives. As far as economic incentives are concerned, however, the degree to which such solutions are meaningful, depends mainly on the characteristics of each specific group and of the collective goods that a cooperative provides to its members[37].

The Portfolio Constraint

The "Portfolio Constraint" is another problem inherent in the vaguely defined property right structure observed in most traditional US cooperative organizations, and was introduced by Jensen and Meckling (1979) in their discussion of problems facing labor-managed firms. In such firms, workers' shares in the firm's cash flows are similar to non-marketable finite lived shares of common stock. Non-marketability of shares implies that the firm owners (workers in labor-managed firms, member-patrons in cooperatives) cannot diversify their holding across many different firms and assets. This leads to a non-Pareto optimal allocation of risk, because there is no opportunity for specialization of risk bearing across individuals with different degrees of risk aversion and wealth. Additionally, the worker-investors are forced in the aggregate to bear risks that cannot be minimized through diversification (Jensen and Meckling 1979, p. 486).

This framework has been employed to study the portfolio constraint of traditional agricultural cooperatives. The starting point is that non-transferability, illiquidity and lack of appreciation mechanisms for exchange are included among the major

[37] For a detailed analysis of such incentives, the reader is referred to the previous sections on the free rider constraint.

characteristics of cooperative residual claims.[38] These create an investment environment in which members are prevented from adjusting their cooperative asset portfolio to match their personal risk preferences and thus they pressure board members and the management to rearrange the cooperative's investment portfolio even if the reduced risk portfolio entails lower expected returns (e.g., Condon 1990).

Cooperative Investment Behavior and the Portfolio Constraint

The portfolio problem is better understood under the assumption that a cooperative firm provides its members with the option of purchasing shares in the cooperative that are marketable/transferable. Then, given members' individual constraints, the question becomes how should they allocate their wealth to achieve an optimal investment portfolio. The traditional (mean-variance) analysis of this question is based on three main assumptions:

1. Members dislike risk and like high expected levels of return, where the risk is measured by the variance of the investment returns or their standard deviation.
2. There exists a riskless bond paying a safe rate of return r.
3. Capital markets are perfect; that is, a member-investor can buy or sell as much of any security as she likes without affecting the security's price and without incurring significant buying or selling costs[39].

[38] For a detailed discussion of these characteristics, the reader is referred to Chapter 3 of this volume.
[39] While assumptions 2 and 3 are obviously unrealistic, when relaxed the impact is one of degree rather one of kind.

The following discussion of the investment problem facing the cooperative member, refers to a portfolio which is defined as a vector of numbers (P_1, P_2, …, P_A) indicating what fraction of the total wealth available is to be invested in each asset. A, is a set of assets of which shares are traded: a typical asset α yields an uncertain return $\tilde{R}(\alpha)$, expressed as percentages. Therefore,

$$\sum_{a=1}^{A} P_a = 1$$

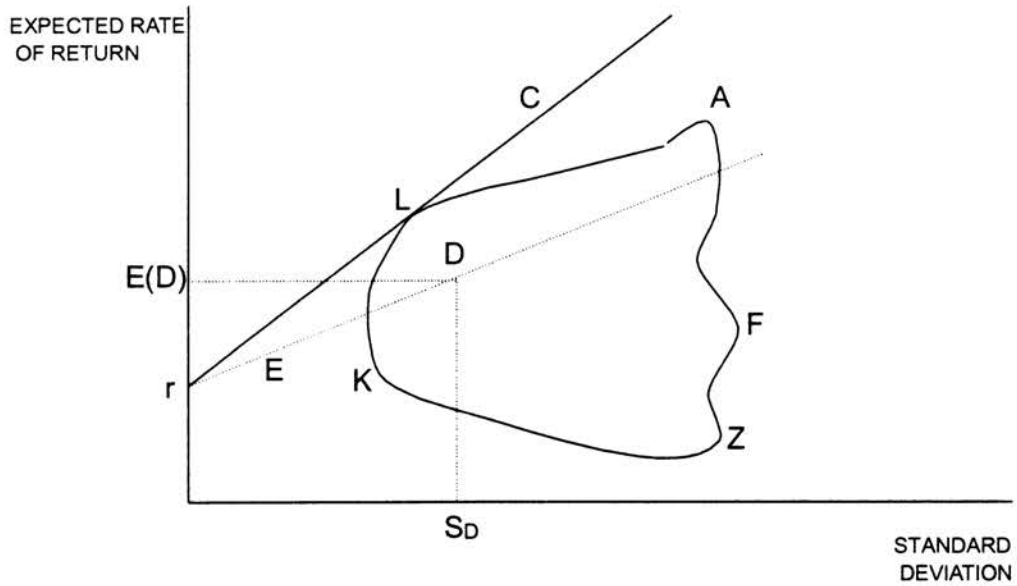
The member's realized return from the portfolio is equal to:

$$\sum_{a=1}^{A} P_a \tilde{R}(\alpha)$$

It is the mean and the variance of this return that the member cares about.

Figure 3.4 illustrates the set of combinations of mean returns and standard deviations that the member can attain by choice of some portfolio.

Figure 3.4. Porfolio Problem-- I



The AFZKL area shows the combinations that can be attained by portfolios of the risky assets alone. Each point in this region represents the return and risk from some single asset or from a portfolio of assets available in the market. The point on the vertical axis at height r is the risk-return pattern given by investing only in the riskless security. In drawing figure 3.4, it was assumed that there exist investments that have higher expected returns than r, although these returns are risky.

By investing a fraction $1 - \beta$ of her wealth in the riskless bond and the remaining fraction β in the risky portfolio D with mean E(D) and standard deviation S_D, the investor creates a new portfolio with mean $(1 - \beta)r + \beta E(D)$ and standard deviation $(1 - \beta)0 + \beta S_D = \beta S_D$ (since $Var[(1 - \beta)r + \beta E(D)] = \beta^2 Var(D) = \beta^2 (S_D)^2$).

For example, investing 1/3 in portfolio D and 2/3 in the riskless bond can attain the risk-return combination E. If the member can borrow at interest rate r, then β can take values greater than 1. In this way, borrowing at rate r and investing all the proceeds in portfolio L can attain point C.

How should members combine risky and riskless assets to assemble a portfolio? As illustrated in Figure 3.4, for any level of standard deviation, the highest mean return obtainable by any portfolio lies on the solid line connecting L to the return of the riskless bond, r. According to the *One-Fund Portfolio Theorem*, for any member who cares only about the mean and standard deviation of returns, the optimal portfolio consists of some mix of the riskless asset and a portfolio of risky assets that has the expected return and standard deviation associated with the point L. An important implication of the One-Fund Portfolio Theorem is the derivation of a pricing formula that indicates how the returns from buying any of the assets available in the market must be related to R(L):

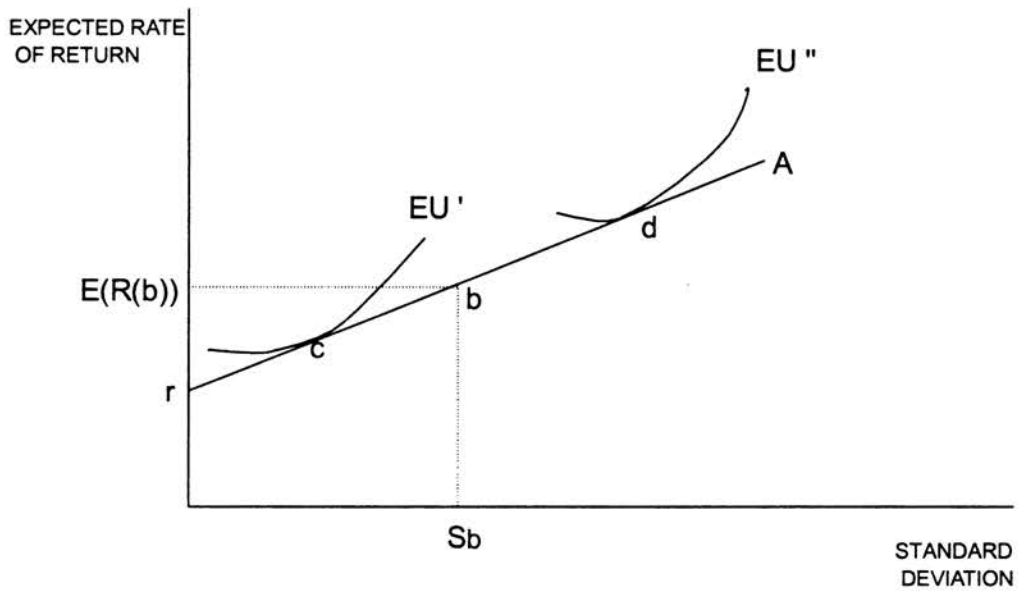
$$E(R) - r = \frac{Cov(R, R(M))}{Var(R(M))}\left(E[R(L)] - r\right) \qquad (3)$$

where R is the uncertain returns from any asset and, [E(R) -r] is the excess return. The proof for this pricing formula can be found in any standard finance textbook and thus is omitted.

Members' Investment Decisions

In the previous section the best investment strategy of an individual cooperative member was derived without considering any particular member's utility function. The specific utility functions were irrelevant for that derivation, because of the assumption of marketable/transferable residual claims made earlier. The major implications of this assumption can be better understood by considering Figure 3.5.

Figure 3.5. Portfolio Problem-- II



Under the assumption of marketable/transferable claims, members who favor lower levels of risk (e.g., those exhibiting a utility function like the one with expected utility EU `) can maximize expected utility by investing in a diversified portfolio that includes both the riskless (R) and the risky (b) assets. Such a portfolio (e.g., c),

according to the pricing formula given above, will have expected return and standard deviation that are linearly related to those of the two underlying investments. The member can hold such a portfolio by selling or buying assets until she reaches the desired level of expected return and standard deviation.

Likewise, investors with risk-return preferences illustrated by expected utility indifference curve EU`` can maximize expected utility by borrowing at the rate r, and investing in additional amounts of the shares of the cooperative (or any other asset), to achieve the risk-return position at d.

What should be clear by now is that the critical assumption enabling cooperative members to maximize their expected utility in the previous analyses was that cooperative residual claims were tradable/transferable. If this assumption does not hold, however, cooperative members will lack the capability to diversify their investments in this fashion. The combination of the role of residual claimant and patron makes it difficult, if not impossible, for members to adjust investment in the cooperative to their desired level of risk (Condon 1990). Additionally, if cooperative members are risk averse they may as well fail to support a cooperative investment strategy that yields a residual return stream such as R(b), and favor instead cooperative investments that yield lower levels of return and lower levels of risk.

The above analysis portrays the essence of the portfolio constraint, whose cause hints at the fact that a member's investment decision is inextricably "tied" to the patronage decision (Cook 1995). Cooperative members are generally required to invest

in their organizations an amount of equity in proportion to their use of the cooperative's services, which yields a given expected value and standard deviation in rate of return. This is to be contrasted to the situation facing IOF stock owners, who can diversify their investments to achieve lower levels of risk or can borrow to achieve higher levels of return (Vitaliano 1985, p. 68). Additionally, it has been demonstrated that the existence of securities markets that allow free choice with respect to the level of assumed risk and the mix of securities to hold, is a prerequisite for an optimal allocation of resources and risk bearing services (Arrow 1964). The absence of such market for cooperative residual claims forces some members to accept a higher level of risk than they would otherwise prefer. Since, in most cases, cooperative equity is a sunk investment, members will attempt to minimize their exposure to risk in ways other than exiting the cooperative; by pressing the cooperative to rearrange its investment portfolio toward less risky investments, even if the new portfolio implies lower expected returns (Condon 1990, p. 96).

The portfolio constraint can be expected to give rise to further differences in the preferences among subgroups of a cooperative's members, with a general tendency to favor decisions with lower levels of risk (Vitaliano 1983, p. 1082). These diverse member preferences, resulting from different member attitudes toward risk, have several important implications with respect to cooperative investment behavior and the choice of the strategies to be pursued by the cooperative.

For example, Rhodes notes[40] that farmers are reluctant to allow their cooperatives to diversify into business unrelated to farming because their investment in the cooperative is largely sunk. For activities unrelated to farming, the farmers can receive the same investment service from an IOF and have far greater liquidity of residual claims than they would through a cooperative. Only when the cooperative provides services that strengthen the farming operation and that are not available through IOFs, are farmers willing to accept the illiquidity that characterizes cooperative residual claims.

A closely related argument on why cooperative members prefer less risky investments is presented by Staatz (1987d, p. 39), who maintains that producers invest in agricultural cooperatives in order to empower their farm businesses. Such investments can be viewed as representing a further "financial commitment to a particular line of business rather than a diversification of their portfolios." Further, since residual claim ownership and patronage are tied, no specialized agents exist to handle cooperative stock. These agents would be more risk-taking than cooperative members or could spread their risk by diversifying their portfolios. Because cooperative members tend to have "all their eggs in one basket," they may pressure management to adopt conservative business strategies that expose them to lower levels of risk.

[40] See Staatz (1987d, p. 55, endnote 12).

Another significant consequence relates to risk sharing through a single pool of products, adopted by many marketing cooperatives[41]. With a single pool, a number of different commodities are marketed together and thus the total payment received by members reflects not only the market performance of their product but also the profitability of the other products in the pool[42]. Hence, some members may be reluctant to accept pooling, when it is associated with a constantly higher risks due to inclusion in the pool of less profitable products. Consequently, pooling may negatively affect members' incentives to invest in their cooperative.

Through pooling, a member's risk exposure does not depend solely on the performance of her commodity in the market but, also, on how profitable the other commodities handled by the cooperative are. This may create no problem as long as good and bad years are balanced between different commodities. However, when a group of members constantly receives for its product a price lower than the one prevailing in the market, this group in fact subsidizes the producers of less profitable commodities. Since those members are forced to accept more risk than that associated with their farm business, they may pressure cooperative decision makers to: (1) make less risky investments to balance out their already high exposure to risk, (2) stop accepting members producing unprofitable commodities and, if they become a majority, to switch to a closed membership policy, and (3) make more conservative business

[41] As Cobia (1989, p. 198) notes, "...infrequently, supply cooperatives may pool orders for inputs and then shop for the best price."

[42] An average price is paid to each member—after the pool has been closed—regardless of the market price of each commodity.

strategy decisions. Risk management strategies may not be to cooperative members as important today as they used to be in an earlier era, because nowadays farmers have access to a range of opportunities for managing risk themselves (e.g., futures, options, etc.) (Peterson 1993, p. 279).

An even more important aspect of the portfolio constraint relates to "common equity pools." As an example, suppose that a Nourse II, multi-purpose cooperative operates two branches: livestock feed, and agronomy (wheat, corn, and soybeans). Furthermore, suppose that the cooperative's management suggests to the Board of Directors that a considerable investment in a new soybean processing plant would allow soybean producers to capture a higher percentage of the consumer dollar spent in the soybean agri-chain. In case the cooperative adopts a common equity pool system, the leverage (debt) capacity of all members is "placed in a single pool," regardless of the type (feed or agronomy) or the amount of business they do with the cooperative. As a result, if the cooperative board decides to invest in the new plant the leverage capacity of those members who benefit only through the livestock feed branch of the cooperative firm is also used to finance the new investment. In this way, members who will not use the new facility assume part of the risk associated with the new venture. Although this example is a simplified version of situations observed in reality, it is indicative of the associated significant problems that arise in traditional cooperatives when members do not have the freedom to adjust their investment portfolio to match their risk preferences.

In conclusion, the portfolio constraint affects negatively both individual members and the cooperative as a whole. Farmer-members in agricultural cooperatives characterized by traditional property rights structures, are either forced to accept more risk than they would prefer, or denied the opportunity to achieve higher returns through more risk-taking. As a result, the cooperative firm is faced with four important constraints: (1) a limited pool of potential equity capital providers, (2) a tendency toward less diversification that may be a prerequisite for survival, (3) a tendency toward more conservative, less risky business strategies and investments, and (4) a difficulty to adopt some traditional collective action risk management strategies. The above discussion indicates that any attempt toward the amelioration of the portfolio constraint would:

(1) allow cooperative members to adjust their investment portfolio to match their risk preferences, and at the same time,

(2) provide the cooperative firm with enough flexibility to invest in profitable ventures that increase the firm's value while members' shares in this increased value are in proportion to their individual contributions.

With the discussion of the portfolio constraint, the analysis of the investment constraints is concluded. Table 3.3 summarizes the above analysis in terms of the derived hypotheses.

Table 3.3 Summary of Hypotheses

Main Hypothesis	
H_0:	Cooperative principles, regulations, and bylaws, create and promote a second dimension of coop firm traditional property rights structure, characterized by non-transferable, non-redeemable and limited time horizon residual claims, that results in misalignment of residual rights of control and residual claimant rights. This property rights structure does not provide cooperative members with the necessary incentives to invest in their organizations. On the other hand, new forms of collective action, in agriculture, designed to achieve a better alignment of residual claimant and residual control rights, enhance members' willingness to invest in their cooperatives significant amounts of risk capital.
Hypotheses Related to the External Free Rider Constraint	
H_1:	Cooperative membership policy (open/closed) significantly affects the amount of equity capital invested by each member in the cooperative (Cook 1995; Porter and Scully 1987, p. 496).
H_2:	Cooperative policies, such as marketing or uniform grower agreements, that increase members' pre-commitment to their cooperative, ameliorate the external free rider problem (Staatz 1987d, p. 43; Cook and Iliopoulos 1998).
Hypotheses Related to the Internal Free Rider Constraint	
H_3:	In general, cooperative members favor decisions that increase total payments to each member relative to decisions requiring the investment of significant amounts of members' risk capital (Vitaliano 1983, p. 1082; Cook 1995, p. 1157).
H_4:	Restricted or closed membership policies are mostly observed in cooperatives where the effects of business decisions are fully captured in the cooperative's cash flows (e.g., through sale of a brand name product) (Vitaliano 1983, p. 1082).

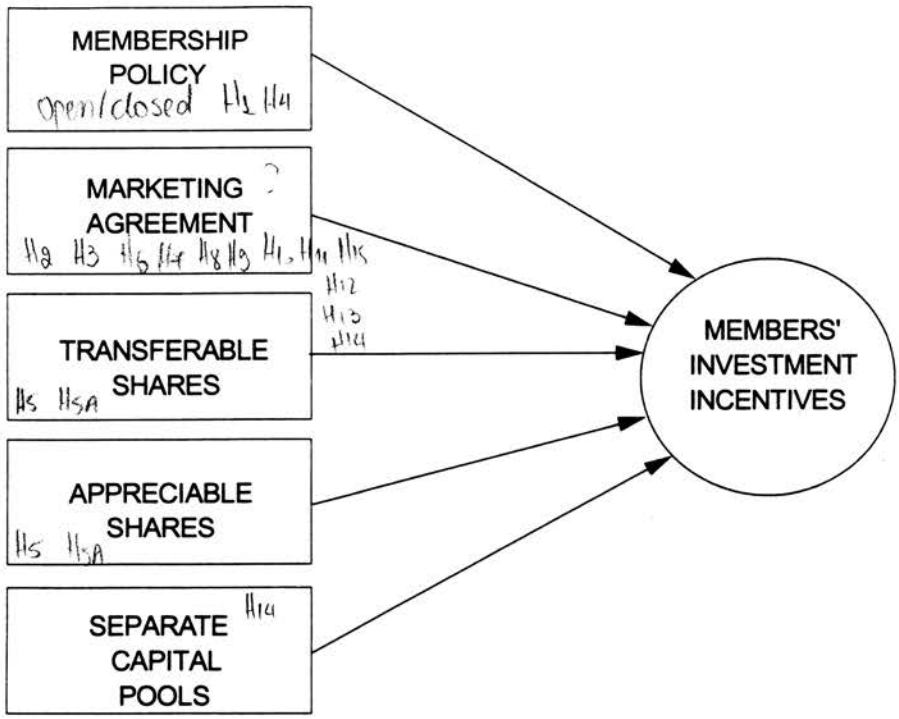
WTI = f(PS)

Table 3.3. Summary of Hypotheses (Continued)	
H_5:	Transferable and appreciable ownership rights help ameliorate the free rider constraint (Cook 1995; chapter 3, in this study).
Hypotheses Related to the Horizon Constraint	
H_{5A}:	Transferable and appreciable ownership rights help ameliorate the horizon constraint (Cook 1995; chapter 3, in this study).
H_6:	Cooperatives spend a low percentage of their operating budget on investments related to R&D and other intangible assets, such as advertising, when compared to the amounts invested in such activities by investor-oriented firms (Porter and Scully 1987, p. 495; Cook 1995).
H_7:	When the horizon constraints is not ameliorated, members pressure the Board and/or top management to: • Increase the proportion of the cooperative's cash flow devoted to current payments relative to investment. • Accelerate equity redemptions at the expense of retained earnings (Cook 1995).
H_8:	Cooperatives that use an equity redemption plan with relatively short (less than seven years) period of equity revolvement, have a higher investment per member, than cooperatives that do not have any equity redemption plan, or have a plan of a long (more than seven years) revolving period (chapter three, in this study).
H_9:	Cooperatives are expected to borrow under conditions that place the repayment burden on future generations Staatz 1987, p. 45).
H_{10}:	In general, cooperatives issue long-term bonds with low coupons, and no sinking-fund provisions, as current members attempt to shift risk from themselves to future generations of members (Staatz 1987, p. 46).

Table 3.3. Summary of Hypotheses (Continued)	
H_{11}:	Due to the horizon constraint, members pressure top management and the Board to liquidate their cooperative's assets, in whole or in part. This pressure is not intense in states where the incorporation statutes specify that in the case of total liquidation a cooperative's assets must be distributed among past as well as current patrons (Staatz 1987, p. 46).
Hypotheses Related to the Portfolio Constraint	
H_{5B}:	Transferable and appreciable ownership rights help ameliorate the portfolio constraint (Cook 1995; chapter 3, in this study).
H_{12}:	Cooperative members usually favor cooperative business decisions associated with lower levels of risk (Vitaliano 1983, p. 1082; Cook 1995, p. 1158).
H_{13}:	Cooperative members are reluctant to support investments, by their cooperative, in business activities unrelated to those in which the cooperative is already involved (Cook 1995).
H_{14}:	In multi-purpose cooperatives with common equity capital pools, members invest less per member, than in those operate separate capital pools (Hansmann 1996, p. 138).
H_{15}:	Payment of interest on members' allocated equity capital is expected to ameliorate, at least to some extent, the portfolio constraint (Staatz 1987, p. 49).

The main hypothesis of this research is usefully summarized in the following path diagram (figure 3.6).

Figure 3.6. Path Diagram of Investment Constraints



Investment constraints are not the only property right problems facing US agricultural cooperatives. Another set of property right problems, collective decision-making constraints (the control and influence costs constraints) directly affect members' incentives to support efficient collective decision-making within their organizations. The control constraint is associated with the agency costs that arise when trying to prevent the divergence of interests between the membership and their representative board of directors (principal) and management (agent) in a cooperative. Since the information provided and external pressures exerted by publicly traded equity instruments is not

present in agricultural cooperatives, and the members serving on board of directors have little or no business education/experience, governance bodies operate with a handicap.

The influence costs constraint refers to the costs resulting from influence activities. Influence activities arise in organizations when organizational decisions affect the distribution of wealth, or other benefits among members or constituent groups of the organization and in pursuit of their selfish interests, the affected individuals or groups attempt to influence the decision to their benefit. The influence costs problem can be viewed as a collective decision making problem. Because shares in the cooperatives are not transferable, members that cannot exit the cooperative they are left with only one option-- voice. Especially if the cooperative is engaged in a wide range of activities, then diverse objectives among its members can lead to damaging influence activities that increase transaction costs within the cooperative, lead to wrong or no decisions at all and finally, may lead to the dissolution of the cooperative. This study focuses on the investment constraints, while the collective decision-making problems are addressed in forthcoming work.

CHAPTER FOUR

SURVEY AND EMPIRICAL METHODOLOGY

Understanding the property rights structure of US agricultural cooperatives was a prerequisite for the accomplishment of this research's objectives. Likewise, a detailed comparison and contrast of these characteristics between traditional cooperatives and cooperatives with more innovative property rights structures, was necessary.

Two types of primary data were required: data on quantitative and qualitative observable variables, and data on variables that measure unobserved constructs. Additionally, since a considerable amount of data was required, a mail survey was chosen as the most suitable way for acquiring all required information. In developing the survey instruments, several important considerations had to be made due to the character of the questions to be included and the unique property rights characteristics of agricultural cooperatives. The steps in developing the survey methodology and the statistical methods used in analyzing the acquired information are presented in the remainder of this chapter.

Sample Selection

The Population

The first step in designing the survey was the identification of an appropriate sample, based on several criteria which dictated that the sample should: (1) be representative of US agricultural cooperatives, (2) include both cooperatives with traditional and innovative property rights structure,[43] so that a meaningful comparison could be made, (3) be large enough to allow substantial inference-making, and (4) include large and diversified cooperatives with a high chance of being in need of considerable amounts of risk capital since, in such cooperatives the effects of the five vaguely defined property rights constraints are expected to be more intense. Under these considerations, the sample surveyed in this study includes: (i) the population of Nourse II, multi-purpose cooperatives, (ii) the population of Sapiro II, marketing cooperatives, (iii) the population of Sapiro III, new generation marketing cooperatives that are currently operating, and (iv) the one hundred most innovative Nourse I, local cooperatives as identified by a set of national observers[44].

Population, in this case, should be taken to imply the top 100 largest US agricultural cooperatives. These cooperatives, according to USDA[45], represent more than

[43] See chapter three for a definition of a traditional cooperative.
[44] These national observers include national trade associations, state trade associations, extension specialists, insurance companies, government agencies, and others.
[45] All information with respect to the top 100 US agricultural cooperatives is from *Rural Cooperatives*, issue September/October 1997, published by USDA.

65% to 70% of the total operating revenues by US agricultural cooperatives, in 1996. During 1996, the US one hundred largest agricultural cooperatives totaled more than $74 billion in gross turnover. Additionally, farm supply cooperatives' sales were approximately $19 billion. However, seventy percent of the gains in 1996 were attributable to just five cooperatives, all included in the sample to be surveyed. Seventy five percent of the marketing sales, during 1996, by US agricultural cooperatives were also attributable to just ten cooperatives—all included in the sample of cooperatives surveyed in this research.

The addresses and CEO names for NII and SII cooperatives were obtained from the list of participants in the Graduate Institute of Cooperative Leadership (GICL) at the University of Missouri, Department of Agricultural Economics (from the National Cooperative Business Association, and National Council of Farmer Cooperatives lists). A combination of internet searches, consultation of publications on new generation cooperatives, and the new generation cooperative database at the University of Missouri obtained all information regarding new generation cooperatives.

Identification of the Appropriate Respondents within Each Cooperative

The next step was the identification of homogeneously and well informed respondents within each cooperative, that would increase the reliability of the acquired data. The required information was clustered into five parts:

(a) information on property rights structure,

(b) financial information on equity acquisition methods, equity redemption plans, R&D investment, and intangible asset information,

(c) organizational design information,

(d) information on members' and Board of Directors' behavior, and

(e) information on top management (mainly CEO) behavior and perceptions of critical cooperative issues.

Since the sample satisfying all the above criteria was relatively large, a mail survey was preferred to other types of surveys (telephone surveys, personal interviews, etc.) mainly due to the high cost of these alternatives.

To maximize reliability and at the same time minimize costs, an innovative survey design was adopted. Two questionnaires were sent to each cooperative in the sample: one to be answered by the CEO, and the other either by the CEO or the person most knowledgeable of cooperative financial issues. However, while the CEO questionnaire was the same for all cooperatives in the sample, the top management ones were different, depending on whether the cooperative was a Sapiro or a Nourse cooperative. This last choice was justified by the different focus of these cooperatives; Sapiro cooperatives focus almost exclusively on marketing their members' products, while Nourse cooperatives are more diversified (with both input supply and marketing operations) and, subsequently, have different equity and equity capital revolvement payment requirements.

Survey Procedure

Structure of the Survey

The design of the mail survey (Appendix Two) focused on collecting mostly qualitative information, although several quantitative questions were included as well. All questions were in a close-ended format to achieve the highest possible levels of standardization and user-friendliness.

Initially, questions were written according to the order of the hypotheses to be tested (and by each of the constraints) but they were reordered to facilitate the respondents ability to answer, and allow CEO's and top management to openly provide reliable information on issues related to their perceptions of cooperative issues. Before constructing the initial survey numerous personal interviews[46] with cooperative top management, members of the Board of Directors, and researchers from various institutes, in the form of open-ended questionnaires, provided valuable information in designing the survey instruments.

Focus Group

The initial survey was designed and carefully structured in the period between December 1997 and January 1998. A focus group was organized in January 1998 to discuss both the design and the context of the questionnaires. The group included Dr. Michael L. Cook

[46] These personal interviews were conducted during the period January 1997 through December 1997.

and Kristi Livingston, Executive Secretary of the Missouri Institute of Cooperatives (MIC). Numerous meetings were held during January and February 1998 that resulted in the complete redesign of the mail survey instrument. A focus group approach was preferred, since a pre-testing of the survey instruments was unfeasible because of the small total population to be surveyed.

The Mail Survey Process

As previously explained, two questionnaires (CEO Survey, and Top Management Survey) were sent to each cooperative in the sample; both were sent to the CEO of each cooperative, with a request to either answer both of them, or ask the top management person most knowledgeable of financial and member issues to answer the top management survey.

Surveys were mailed in three waves, in the period between February 1998 and April 1998. First, the Sapiro II and Nourse II surveys were sent, followed by the Sapiro III and finally by the Nourse I survey. Three weeks after each of these mailings was completed, follow-up surveys were sent to those cooperatives that had not responded. Also, thank you letters were mailed to those cooperatives that returned both surveys.

To the cooperatives that responded by sending either the CEO or the top management survey but not both, a letter thanking them for their response was sent, kindly requesting that they complete the other survey as well. Additionally, in all these types of thank you letters, a request for the 1997 annual report of the cooperative was

included. To cooperatives that had not replied at all, a reminder letter was sent, including a stamped card, asking the CEO to mail it to the University of Missouri-Columbia, indicating whether one or both of the surveys were needed.

Each cooperative received a letter (see Appendix One) introducing the project and the research team. A request for answering the two questionnaires was included along with two stamped return-envelopes. The need for accuracy in answering the survey questions was adequately highlighted, and detailed instructions were included. Also, the respondents were assured of complete confidentiality, regarding both their responses and their cooperatives' annual reports. The adoption of these methods produced a 61% response rate.

Analysis

The mail survey provided valuable information about property rights, financial, organizational, and stakeholder characteristics of each cooperative. Translating this information into a useful form required the use of several statistical techniques. First, descriptive and inferential statistical methods were employed: frequency tables, measures of central tendency, measures of dispersion, analysis of contingency tables, and measurement of association between different types of variables. Additionally, testing the central hypothesis of this research, namely, that property rights structures have a significant impact on members' incentives to finance their cooperative, needed a different empirical treatment. Since latent variables were involved and the estimation of multiple

and interrelated dependence relationships was required, a structural equation model with latent variables was developed.

Descriptive and Inferential Statistics

Analyzing the survey data involved descriptive statistics such as the mean, the mode, the median, the range, and percentiles[47]. The qualitative data was also summarized in frequency tables for each measured variable, and contingency tables when two variables were involved.

Beyond describing the results of the mail surveys, inferential techniques provide useful insight into possible associations and relationships between variables. Much of the data acquired in this survey was qualitative in nature and thus was measured on nominal and, in some cases, ordinal scales. Chi-square (χ^2) tests, difference of means tests, and correlation analysis were used to assess the relationships between the variables of interest. Additionally, where these relationships were found to be statistically significant, Cramer's V and phi tests, lambda, and gamma tests were used to measure the strength of the relationships.

Testing the Significance of Survey Data: The chi-square (χ^2) Test of Significance

The chi-square (χ^2) test of statistical significance is the most frequently used test in survey research. It is the only test available for data with both variables measured on the

[47] The 25%, 50% and 75% percentiles were calculated.

nominal scale but data measured on either the ordinal or the interval scales, can also be tested using chi-square (χ^2).

The chi-square (χ^2) test of significance is essentially concerned with the differences observed between the frequencies that are *obtained* from the sample survey and those that are *expected* to be obtained if there were no differences among the categories of the variables. The assumption that no difference exists among the categories of the variables is known as the null hypothesis. The chi-square (χ^2) test seeks to identify whether the perceived findings are genuine or the result of sampling error.

Calculation of the chi-square (χ^2) statistic consists of measuring the difference between the expected frequencies and those actually obtained through the survey process, using the following equation:

$$\chi^2 = \sum \frac{(f_0 - f_e)}{f_e} \qquad (4.1)$$

where f_0 is the frequency observed in each cell and f_e is the frequency expected in each cell under the assumption of no difference.

The first step in the calculation of chi-square (χ^2) is the establishment of a chi-square matrix worksheet consisting of obtained and expected frequencies, like the sample table below.

Table 4.1 Sample 2 x 2 Contingency Table

	Columns		Row Totals
Rows	a (Ea)	b (Eb)	a+b
	c (Ec)	d (Ed)	c+d
Column Totals	a+c	b+d	N

Letters a, b, c, and d, denote the observed frequencies for each of the four categories, while Ea, Eb, Ec, and Ed, are the corresponding expected frequencies. Expected frequencies are calculated using the following equation:

$$(E) = (\text{Row Total})\ (\text{Column Total}) / (\text{Total Sample size}) \qquad (4.2)$$

For the above table and for the expected frequency of, say, b this equation becomes:

$$(Eb) = (a+b)\ (b+d) / N \qquad (4.3)$$

To interpret the calculated chi-square, reference is made to a table of critical chi-square values, which show the required magnitude of the calculated chi-square in order to achieve statistical significance. That is, if the calculated chi-square (χ^2) equals or is greater than the critical chi-square from the table (χ^{2*}), the differences between obtained and expected frequencies within the cells are considered to be a reflection of genuine difference between the categories of the variable. This difference indicates that a statistically significant relationship exists between the variables. If the calculated chi-square is less than the critical chi-square, then no relationship between the variables has

been identified, which in this case would allow no immediate alternative other than to assume that no genuine relationship exists between the considered variables.

In order to identify the critical chi-square for a table like the sample contingency table above, two sets of information are required. First, a decision must be made on the appropriate level of confidence (generally 95 percent or 99 percent). Second, *degrees of freedom* must be determined. The simple rule for degrees of freedom for chi-square involves the following formula:

$$df = (r-1)(c-1) \qquad (4.4)$$

where df = degrees of freedom

r = number of categories of the dependent variable (row variable)

c = number of categories of the independent variable (column variable)

Degrees of freedom for the sample contingency table are calculated as

$$df = (2\text{-}1)\ (2\text{-}1) = 1$$

Additional Chi-Square (χ^2) Considerations

The use of chi-square is subject to certain restrictions and is more reliable as the overall sample size increases. Consistent with this principle is the rule of thumb that each cell of the contingency table should contain an expected frequency of at least 5. If the expected frequency falls below 5 in any one cell, categories should be merged to eliminate the problem.

However, tables consisting of two categories of independent variables and two categories of dependent variables (commonly referred to as 2 x 2 tables) present the researcher with additional concerns. For example, if a 2 x 2 table contains cells with expected frequencies of less than 5, no merging of categories is possible and a somewhat different test must be employed, known as Fisher's Exact Test (Rea and Parker 1997). Additionally, since the results in a 2 x 2 table can be distorted if any one cell contains an expected frequency of less than 10, it is frequently recommended that the Yates correction be employed, which entails reducing the magnitude of the difference between observed frequencies and expected frequencies in each of the four cells by 0.5. Most computer software programs perform this correction automatically.

Two additional assumptions about the data used in calculating chi-square (χ^2) statistics are required: first, that the categories in the contingency table are mutually exclusive so that each member of the sample can be assigned to only one cell and, second, that the observations in the sample are randomly and independently drawn (Rea and Parker 1997).

Finally, a chi-square test can also be used to test the hypothesis that there is no difference between the categories of a single variable (null hypothesis). The same procedure is followed in this case and the calculated chi-square must be compared to a critical one obtained from the relevant table.

Testing the Significance of Survey Data:
Difference of Means Test

When a contingency table contains a dependent variable on the interval scale and an independent variable consisting of two categories at any scale, there is a more powerful test of significance available than the chi-square. This test involves the comparison of the arithmetic means of the independent variable and is known as the Difference of Means Test.

The equation for the test is:

$$Z = \frac{\bar{x}_i - \bar{x}_j}{\sqrt{\frac{s_i^2}{n_i} + \frac{s_j^2}{n_j}}} \qquad (4.5)$$

where $\bar{x}_i$ is the arithmetic mean for category i of the independent variable; x_j is the arithmetic mean for category j of the independent variable; s_i^2 is the standard deviation for category i; s_j^2 is the standard deviation for category j; and n_i and n_j are the observations falling in category i and j, respectively.

Testing the Significance of Survey Data:
Pearson Product-Moment Coefficient of Correlation (r)

This measure of correlation is used to evaluate the linear association between two variables measured on the interval scale. The Pearson product-moment correlation between variables A and B, can be calculated in several ways, the most common of which is according to the following formula (Cramer 1994):

$$r = \frac{Cov(A,B)}{\sqrt{(VarA) \times (VarB)}}$$

Covariance is the sum of products of the deviation of the score of one variable (A) from its mean multiplied by the deviation of the corresponding score of the other variable (B) for all pairs of scores, which is then divided by the number of cases or pairs minus 1:

$$Cov(A,B) = \sum_{i=1}^{N}\left(A_i - \bar{A}\right)\left(B_i - \bar{B}\right)\frac{1}{N-1}$$

Variance is the sum of squares of the deviation of each score from its mean, which is then divided by the total number of cases minus 1:

$$Var(A) = \frac{1}{N-1}\sum\left(A_i - \bar{A}\right)^2,$$
$$Var(B) = \frac{1}{N-1}\sum\left(B_i - \bar{B}\right)^2$$

Pearson's r varies between -1 and +1. One way of conceptualizing Pearson's correlation is to think of it as the ratio of the variance shared by two variables compared with the overall variance of the two variables. If the shared variance is high, then this variance will be similar to the overall variance and so the correlation will come close to -1 or to +1. If there is no shared variance (i.e. zero shared variance), then the correlation will be zero. Positive values for the coefficient of correlation, r, indicate that both variables move toward the same direction; when A increases, B increases as well. Negative values, on the other hand, show an inverse relation; when A increases, B decreases, and vice versa.

Structural Equations with Latent Variables

Structural equation modeling encompasses an entire family of models known by many names, among them covariance structure analysis, latent variable analysis, and often simply LISREL[48] analysis. Structural equation modeling has resulted from an evolution of multi-equation modeling developed principally in econometrics and merged with principles of measurement from psychology and sociology.

All structural equation-modeling techniques are distinguished by two characteristics (Hair et al. 1995, p. 622): (1) estimation of multiple and interrelated dependence relationships, and (2) the ability to represent unobserved concepts in these relationships and account for measurement error in the estimation process. Both of these characteristics of structural equation models make them the most suitable method for estimating the relationships depicted in Figure 3.6.

Structural equation modeling can be described as a process that follows seven steps (Hair et al. 1995).

Step 1: Developing a theoretically based model,

Step 2: Constructing a path diagram of causal relationships,

Step 3: Converting the path diagram into a set of structural equations and measurement equations,

Step 4: Choosing the input matrix type to be used,

Step 5: Assessing the identification of the model equations, and estimating the

[48] LISREL is the most popular software programs for performing such analysis.

proposed model,

Step 6: Evaluating the results for goodness-of-fit, and

Step 7: Making the indicated modifications to the model if theoretically justified.

These steps are discussed in detail in Appendix Three, even though some of the standard methodology in SEMs had to be modified in view of the model constructed in this research.

CHAPTER FIVE

EMPIRICAL RESULTS

This chapter presents the obtained statistical results. First, descriptive and inferential statistics are given for each of the property rights constraints in tables and/or charts, accompanied by brief narrative descriptions. Several of the hypotheses summarized in chapter three are tested through inferential statistical methods. Cross-tabulations of the relevant variables are given, and a discussion of the evidence supporting or rejecting each hypothesis follows. The second part of this chapter presents the results of the structural equation model of the investment property rights constraints. A brief discussion of the results at the end of the chapter explain their importance in accepting or rejecting the main hypothesis of this research, and under what conditions.

Descriptive and Inferential Statistics Related to the Free Rider Constraint

The free rider constraint refers to both non-members free riding on public goods provided by the cooperative (external free rider), and to the dilution of the rate of returns between existing and incoming members (internal free rider). The degree to which a cooperative succeeds in ensuring that members and prospective members are committed to the cooperative is critical for achieving its goals. A closed or defined membership policy is a means of achieving member commitment. However, open membership has always been a tradition for US agricultural cooperatives since it was thought to be an indicator of true

cooperation. Even today, as cooperative principles and cooperative structures are reconsidered, most US agricultural cooperatives responding to the survey (57%), adopt an open membership policy (Table 5.1). These numbers for Sapiro and Nourse cooperatives are 33.8% (open membership, Table 5.2) and 81.5% (open membership, Table 5.3), respectively.

Table 5.1. The Frequency of Closed versus Open Membership Policies in Responding Cooperatives—1998

	Frequency	Percent
Closed Membership	55	42.6%
Open Membership	74	57.4%
Total	129	100%

Table 5.2. The Frequency of Closed versus Open Membership Policies in Sapiro Responding Cooperatives--1998

	Frequency	Percent
Closed Membership	46	66.2%
Open Membership	20	33.8%
Total	66	100%

Table 5.3. The Frequency of Closed versus Open Membership Policies in Responding Nourse Cooperatives—1998		
	Frequency	Percent
Closed Membership	9	14.3%
Open Membership	54	85.7%
Total	63	100%

It was argued in chapter three[49] that a closed membership policy would be expected in cooperatives where the effects of decisions can be captured in the cooperative's cash flows (e.g., through the sale of a brand name product). Half of the cooperatives that responded confirmed to have one or more brand name products (Table 5.4).

Table 5.4. Number of Responding Cooperatives that Have Brand Name Products—1998		
	Frequency	Percent
No	55	50.0%
Yes	55	50.0%
Total	110	100%

In a cross-tabulation of membership policy and the variable "The Cooperative Has Brand Name Products," it was found (Table 5.5) that closed membership is mostly observed in cooperatives with brand name products. However, a chi-square (χ^2) of 1.028 (1 d.f.), indicates no statistically significant association between the two variables.

[49] See hypothesis 4 in chapter three.

Table 5.5. Adopted Membership Policy By Sale of Brand Name Products in Responding Cooperatives			
Membership Policy	**The Cooperative Has Brand Name Products**		
	NO	YES	TOTAL
Closed	14.8%	19.4%	34.3%
Open	35.2%	30.6%	65.7%
Total	50.0%	50.0%	100.0%

χ^2=1.028 (d.f.=1), $\chi^2_{critical}$= 3.841 (5%) and 6.635 (1%)

To reveal the significance of the external free rider constraint top managers were asked whether their cooperative had attempted to expand its membership during the last five years. The majority (78%) replied that their cooperative had attempted to attract new members (Table 8.6). This high percentage can be viewed as an indicator of cooperatives' attempts to convince a larger percentage of farmers to contribute to the provision of the public—cooperative—good. It should be noted that this high percentage may be due to the inclusion of new generation cooperatives in the sample which might have reported an attempt to expand membership, as a result of the issuance of new delivery rights to utilize additional capacity in their processing plants.

Table 5.6. Responding Cooperatives that Have Attempted to Expand their Membership During the Last Five Years—1998		
	Frequency	Percent
No	25	22.5%
Yes	86	77.5%
Total	111	100%

Transferability of a member's cooperative ownership rights was proposed as another remedy for dealing with the internal free rider issue (hypothesis 5, chapter three). Three types of transferability were identified in the survey: to family members, to other cooperative members, and to non-members. The majority of the responding cooperatives (70%) allow transfer of their equity stock from members to their family (Table 5.7) while a smaller percentage of cooperatives (60%) allow transfer of shares between members (Table 5.8), and an even smaller percentage (44%) permit transfer of shares to non-members (Table 5.9).

All 28 cooperatives that allow transfer of their equity stock to non-members are Sapiro III, new generation cooperatives in which purchase of delivery rights is a prerequisite for membership. This type of transferability creates a semi-liquid secondary market for a cooperative's equity stock because the bylaws contain stipulations regarding who can own equity in the cooperative[50] and thus restrict the market for equity shares to potential investors who meet these restrictions (Tong 1997). As a result, even the strongest form of transferability is not fully successful in creating a liquid market equivalent to the stock market for IOFs. fantastic

[50] Some of these constraints are: the prospective member (1) must be agricultural producer, producing the defined commodity, (2) must be willing to sign a long-term marketing agreement with the cooperative, and (3) must sign a marketing agreement.

Table 5.7. Frequency of Transferable Cooperative Shares, by Members to their Family, in Responding Sapiro Cooperatives—1998

	Frequency	Percent
Non-transferable	19	29.7%
Transferable	45	70.3%
Total	64	100%

Table 5.8. Frequency of Transferable Cooperative Shares, by Members to other Members, in responding Sapiro Cooperatives—1998

	Frequency	Percent
Non-transferable	26	40.6%
Transferable	38	59.4%
Total	64	100%

Table 5.9. Frequency of Transferable Cooperative Shares, by Members to Non-members, in Responding Sapiro Cooperatives—1998

	Frequency	Percent
Non-transferable	36	56.3%
Transferable	28	43.8
Total	64	100%

Transferability of cooperative equity shares along with appreciability of these instruments, are also a way to ameliorate the horizon problem. Another issue related to a

transferable and appreciable instrument involves the issuance of delivery rights.[51] Linking equity shares to delivery commitments creates value in possessing equity shares. If members must possess equity shares in proportion to their desired level of patronage, owning equity in the cooperative becomes important because, the greater the rents extracted by the cooperative on each unit of members' production, the more valuable owning equity shares becomes as members seek higher returns (Peterson 1994).

Delivery rights are used as a method for achieving member pre-commitment almost exclusively by Sapiro III cooperatives. From the 29 Sapiro cooperatives (45%, Table 5.10) that issue delivery rights to members, 28 are Sapiro III cooperatives. Delivery rights represent a claim to the use of a certain level of the processing capacity of the cooperative but also an obligation to supply the cooperative with enough product to utilize that level of processing capacity. Transferable equity shares or delivery rights entitle members to the residual claims on the cooperative in proportion to their patronage, which also correspond to their level of investment.

Table 5.10. The Frequency of Issuance of Delivery Rights in Responding Sapiro Cooperatives—1998

	Frequency	Percent
No	36	55.4%
Yes	29	44.6%
Total	65	100%

[51] For Sapiro III, new generation cooperatives, transferable shares and delivery rights considered as the same instrument for creating a secondary market for cooperative residual claims.

Traditional marketing cooperatives (SAPIRO II) normally do not issue delivery rights. This may explain to some extent the problems some of them face in achieving a satisfactory level of member pre-commitment (Hansmann 1996).

As argued in chapter three, another important dimension of the free rider problem is the resulting pressure from members to cooperative management and the Board of Directors to distribute most of current earnings in cash (hypothesis 3, chapter three). Sixty seven percent of the CEO's (Table 5.11) reported pressure from active members to distribute most of current earnings in cash.

Table 5.11. Frequency of Active Members Pressing for Distribution of Current Earnings in Cash in Responding Cooperatives--1998

	Frequency	Percent
No	38	33.3%
Yes	76	66.7%
Total	114	100%

When CEO's were asked whether other categories of members were exerting pressure on them for distributing a higher percentage of current earnings in cash, 23% reported such pressure from new members (Table 5.12), 21% from members about to exit the cooperative (Table 5.13), and 8% from inactive members (Table 5.14).

Table 5.12. Frequency of New Members Pressing for Distribution of Current Earnings in Cash in Responding Cooperatives—1998

	Frequency	Percent
No	88	77.2%
Yes	26	22.8%
Total	114	100%

Table 5.13. Frequency of Members About to Exit Pressing for Distribution of Current Earnings in Cash in Responding Cooperatives—1998

	Frequency	Percent
No	90	78.9%
Yes	24	21.1%
Total	114	100%

Table 5.14. Frequency of Inactive Members Pressing for Distribution of Current Earnings in Cash in Responding Cooperatives—1998

	Frequency	Percent
No	105	92.1%
Yes	9	7.9%
Total	114	100%

A related hypothesis stated that a general tendency should be expected for cooperative members to favor decisions that increase organizational cash flows per member, relative to decisions associated with long-term investments (hypothesis 3, chapter three). CEO's were asked to assess how much of a priority the payment of patronage refunds in cash was to their members (Table 5.15). A statistically significant

majority, as indicated by both the observed percentages and the highly significant chi-square, maintains that payment of patronage refunds in cash is a priority for their members (46% moderately high priority, 45% high priority).

Table 5.15. Members' Degree of Priority For Patronage Refunds Paid in Cash Assessed by CEOs in Responding Cooperatives—1998

	Frequency	Percent
Low Priority	3	2.63%
Moderately Low Priority	9	7.89%
Moderately High Priority	52	45.61%
High Priority	50	44.87%
Total	114	100%

χ^2=71.754, (d.f.=3), $\chi^2_{critical}$= 7.815 (5%) and 11.345 (1%)

Member pre-commitment[52] is another significant remedy for both types (internal and external) of the free rider constraint (hypothesis 2, chapter three). Alternative methods followed by cooperatives to achieve a high level of pre-commitment were identified in conversations with cooperative CEO's, members of the focus group, and in the literature. In the majority of Sapiro cooperatives (75%) members are required to sign a marketing agreement with the cooperative (Table 5.16) specifying in some way the volume of the commodity to be delivered by the member and details on the payment method.

[52] The term "pre-commitment" is used here to denote a wide range of alternative mechanisms. These mechanisms are used by cooperatives to attract and maintain members' interest in what is best for the cooperative as a whole, as opposed to pursuing their, narrowly defined, individual goals.

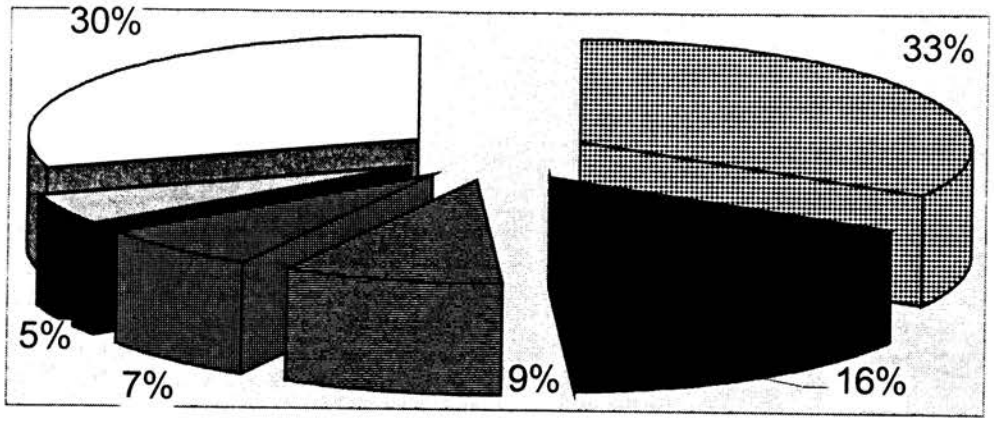
Table 5.16. Frequency of Use of Marketing Agreements Between Members and the Cooperative in Responding Cooperatives—1998

	Frequency	Percent
No	16	24.6%
Yes	49	75.4%
Total	65	100%

The high percent of Sapiro cooperatives that use a marketing agreement as a pre-commitment method imply that the importance of such pre-commitment has been well understood by cooperatives. On the other hand, marketing agreements have been used by some cooperatives (e.g., California marketing cooperatives), not only as a means to achieve members' pre-commitment to the cooperative, but also as methods of supply control.

Such agreements also specify penalties to be incurred in case the terms of the agreement are not fulfilled. Figure 5.1 shows the percentage of cooperatives using each of several alternative penalties for enforcing marketing agreements with their members. In most of the Sapiro cooperatives in this survey (33%), members failing to fulfill their obligations according to the marketing agreement, lose both their patronage and value-added payments. Most of the respondents falling in the "Other" category in Figure5.1 use a combination, or more than one of the above penalties for enforcing marketing agreements.

Figure 5.1. Penalties for Members Violating Marketing Agrrements in US Agricultural Cooperatives--1998



- Loss of Patronage & Value-added Payments – 33%
- Forfeiture of Equity Shares -- 16%
- Member Must Purchase Product from Spot Market – 9%
- The Co-op Purchases Product in Member's Name – 7%
- Member Must Purchase Product from Pool -- 5%
- Other -- 30%

The severity of these penalties implies that a marketing agreement is not sufficient, by itself, to achieve a high degree of pre-commitment. This is also evident from the high percentage (30%) of Sapiro cooperatives that use more than one penalty to assure the enforcement of the marketing agreement.

Another method for achieving member pre-commitment is through the requirement for provision of a significant amount of up-front equity capital by members. While 48% of the responding cooperatives require an up-front equity capital investment from their members (Table 5.17), only nine of them require an investment of more than $ 100 (Table 5.18). The highest required up-front equity capital investment is almost fifty thousand dollars, while five of the responding cooperatives require no up-front investment by their members. The high mean of 2220.6, is the result of a high range (49,999) between the maximum and minimum up-front capital requirement in the responding cooperatives (Table 5.18).

Table 5.17. The Frequency of Requirement for Up-front Capital Investment by Members of Responding Cooperatives—1998

	Frequency	Percent
No	58	52.3%
Yes	53	47.7%
Total	111	100%

Table 5.18. Amount of Up-front Equity Capital Required in responding Cooperatives—1998

Amount ($)	Frequency	Percent
0-10	18	34%
10-25	10	18%
25-100	16	32%
>100	9	16%
Total	53	100%

Mean=2220.64
St.Dev.=7930.62
Range=49999.0

Descriptive and Inferential Statistics Related to the Horizon Constraint

The horizon constraint refers to the unwillingness of members to contribute to the long-term growth of their cooperative, due to the disincentives facing them as a result of vaguely defined property rights.

Several questions on the survey were designed to capture the various aspects of the horizon constraint and provide data for testing hypotheses 6 to 11. First, members' view of the importance of investments in new activities was investigated. Cooperative CEO's were found to believe that investment in new activities is among the priorities of their members: 78% reported that such investments are a high priority for their members (Table 5.19).

Table 5.19. Members' Prioritization of Investments in New Activities, as Viewed by CEOs of Responding Cooperatives—1998

	Frequency	Percent
Low Priority	25	22.2%
High Priority	88	77.8%
Total	113	100%

χ^2=61.678, d.f.=3, $\chi^2_{critical}$=7.815 (5%) and 11.345 (1%)

These percentages may depict members' awareness of the importance of investments in new activities but fail to reveal members' willingness to contribute significant amounts of money to these investments (hypothesis 7, chapter three).

A closely related question referred to the importance of investment in R&D by cooperative members. In the majority of cooperatives that responded (70%) R&D investment is a low priority to members (Table 5.20), and even though 51% of them invest in R&D (Table 5.21), the majority of these cooperatives (83%) devote less than two percent of their gross revenues to R&D activities, as indicated by both the percentages and the high chi-square statistic (61.4, 2 d.f.) in Table 5.22. However, these results are comparable to R&D spending by IOFs in the food industry. In 1996, 61% of the IOFs in food industries reported an R&D budget of less than 0.5% of their gross revenues (Troy 1998). Also, only 4% of IOFs spent more than 2% of their gross revenues in R&D (Troy 1998). Similar results have been reported for other agriculture—related industries. Therefore, while a general tendency for low investment in R&D is observed in the responding cooperatives (hypothesis 6, chapter three), it matches the low R&D spending by IOFs.

Table 5.20. Members' Prioritization of Investments in R&D in Responding Cooperatives—1998

	Frequency	Percent	Cumulative Percent
Low Priority	43	37.7%	37.7%
Moderately Low Priority	36	31.6%	69.3%
Moderately High Priority	26	22.8%	92.1%
High Priority	9	7.9%	100%
Total	114	100%	

χ^2=73.432 (d.f.=3), $\chi^2_{critical}$=7.815 (5%) and 11.345 (1%)

Table 5.21. Frequency of Investment in R&D by Responding Cooperatives—1998

	Frequency	Percent
No	55	49.5%
Yes	56	50.5%
Total	111	100%

Table 5.22. Percentage of Gross Revenues Devoted to R&D Investment by Responding Cooperatives—1998

	Frequency	Percent
2% or Less	45	83.3%
2% - 4%	7	13.0%
4% - 6%	2	3.7%
More than 6%	0	0.0%
Total	54	100.0%

χ^2= 61.444 (d.f.=2), $\chi^2_{critical}$=5.991 (5%) and 9.210 (1%)

Brand name advertisement is another intangible asset in which cooperatives were expected to invest minimally and, while 42% of the cooperatives that responded invest in brand name advertisement (Table 5.23), 70% of those responded devote less than two percent of their operating budget to brand name advertisement (Table 5.24). On the other hand, IOFs in the food industry have increased their advertising budgets during the last years, and only one cooperative is found among the food brands ranked in the top 200 as measured by advertising spending in 1995 (Connor and Schiek 1997). These results

seem to support hypothesis 6, namely, that a general tendency for low investment in intangible assets should be expected among cooperatives.

However, an important dimension of advertising spending must be mentioned at this point. While there is solid evidence that real industry sales increase faster in the presence of intensive advertising (Gallo and Connor 1992), it is still unclear whether advertising causes sales increases or simply becomes more intense as a result of expected sales growth. Thus, low advertising spending by US agricultural cooperatives may be interpreted in a number of ways. For example, it may imply cooperative involvement in industries with declining margins. On the other hand, since average numbers are calculate in tables 5.23, and 5.24, drawing conclusions for the entire population of US agricultural cooperatives is risky. Low advertising expenditures per cooperative may, for example, result from a large number of cooperatives involved in industries that do not require significant advertising spending. These cases should be considered in a more detailed analysis of cooperative advertising expenditures.

Table 5.23. Frequency of Investment in Brand Name Advertisement by Responding Cooperatives—1998

	Frequency	Percent
No	63	57.8%
Yes	46	42.2%
Total	109	100%

Table 5.24. Percentage of Operating Budget Devoted to Brand Name Advertisement by Responding Cooperatives—1998

	Frequency	Percent
2% or Less	28	60.9%
2% - 4%	9	19.6%
4% - 6%	2	4.3%
6% - 8%	1	2.2%
8% - 10%	1	2.2
10% or More	5	10.9
Total	46	100.0%

χ^2=70.954 (d.f.=3), $\chi^2_{critical}$=7.815 (5%) and 11.345 (1%)

The acquired data also support hypothesis 9, namely, that a general tendency should be expected for agricultural cooperatives: borrowing under conditions that place the repayment burden on future generations. From the 1997 annual reports of 98 US agricultural cooperatives several statistics on the debt to equity ratio were calculated (Table 5.25).

Table 5.25. Debt to Equity Ratios for Responding Cooperatives—1998

Debt to Equity Ratio	Frequency	Percent
0-13%	26	26.5%
13%-35%	24	24.5%
35%-70%	24	24.5%
>70%	24	24.5%
Total	98	100%

Mean=60.01%
St.Dev.=0.8257
Range=4.40

An average debt to equity ratio of 60% was calculated, very close to the 51% reported by USDA for the entire population of US agricultural cooperatives for fiscal year 1996[53]. Also, 50% of the responding cooperatives have a debt to equity ratio higher than 34%, while 25% of the cooperatives have a ratio higher than 70%. However, it should be noted that US agricultural cooperatives do not rely on debt more than the IOFs involved in the same industries. This can be inferred from Table 5.26, which reports the average debt to equity ratios for IOFs in several agriculture and food-related industries[54].

Table 5.26. Debt to Equity Ratios for IOFs in Agriculture and Food-related Industries -- 1996

Industry	Debt to Equity Ratio
Meat Products	59.3%
Dairy Products	62.3%
Preserved Fruits and Vegetables	60.5%
Grain Mill Products	66.7%
Sugar	50.7%
Ag Machinery, Equipment and Supplies	68.6%
Other Food	63.3%

Source: Troy (1998)

[53] In Rural Cooperatives, Sept/Oct. 1997, p. 26.

[54] This result is also consistent with the findings of Parlament et al. (1994).

A closely related hypothesis (hypothesis 10) stated that due to the horizon constraint, cooperatives should be expected to issue long-term bonds with no sinking-fund provisions. Indeed, while 14% of the cooperatives that have responded issue long-term bonds (Table 5.27), only one of these cooperatives has any type of sinking fund provision for the issued bonds. These percentages provide some evidence that due to the horizon constraint, cooperative members prefer to transfer financial risks to future members.

Table 5.27. The Frequency of Issuance of Long-Term Bonds by Responding Cooperatives—1998

	Frequency	Percent
No	95	85.6%
Yes	16	14.4%
Total	111	100%

Staatz has argued (hypothesis 11, chapter three), that an indicator of the horizon constraint might be the exercise of pressure from members to the Board of Directors and management to liquidate a cooperative's assets. According to the same hypothesis, this should be expected to happen in states where the incorporation statutes specify that in case of total liquidation, a cooperative's assets must be distributed among past as well as current members. As shown in Table 5.28, in only 8% of the responding cooperatives, did CEOs report such pressure. Since this low percentage was found in states enforcing the above requirement, hypothesis 11 is confirmed.

Table 5.28. Frequency of Membership Pressing for Liquidation of Firm Assets in Responding Cooperatives—1998		
	Frequency	Percent
No	105	92.1%
Yes	9	7.9%
Total	114	100%

It has been argued in chapter three that an effective equity redemption plan can act as a remedy for the horizon constraint because it ameliorates the horizon constraint by aligning members' investment in the cooperative with their level of patronage (Cobia et al. 1989). The majority (76%) of the cooperatives that responded to the corresponding question has a formal plan to redeem equity (Table 5.29). Cobia (1989, p. 268), reports that in 1974, 29% of the cooperatives in a random sample of 857 US agricultural cooperatives, had no planned program to redeem equity. This percentage is close to the 24% of the cooperatives in this study that reported no formal equity redemption plan. Thus, it is obvious that many US agricultural cooperatives have not implemented effective equity redemption plans yet.

Table 5.29. Frequency of Adoption of a Formal Equity Redemption Plan in Responding Cooperatives--1998		
	Frequency	Percent
No	31	24.2%
Yes	97	75.8%
Total	128	100%

Table 5.30 reveals the equity retirement programs used by the responding cooperatives. From the 97 cooperatives with a formal equity plan, the majority (51%) use a traditional--first-in-first-out-- equity revolving plan (Table 5.31) with a revolving period of eight to thirteen years (Table 5.32). The large percentage of cooperatives with revolving periods longer than eight years may indicate that despite the fact that most of the responding cooperatives use some type of equity redemption plan, they fail to return to members their invested capital in a timely fashion. It should also be mentioned that 19% of responding cooperatives used a revolving fund plan with a period of more than twenty years.

Tables 5.32, 5.33, 5.34, and 5.35 show the length of the revolving period for each type of cooperative. Table 5.32 shows that most Nourse I, local cooperatives do not return their members' equity in a timely manner, since only 11% have a revolving period of less than seven years. Not included in Table 5.32 is the only local cooperative that uses a base capital plan, because it has a revolving period between six and ten years.

Nourse II cooperatives also prefer a traditional –first-in-first-out, or percentage-of-all-equities—equity redemption plan. Only three Nourse II cooperatives adopt a base capital plan, but with revolving periods longer than fifteen years. With respect to traditional plans, Table 5.33 shows that the responding Nourse II cooperatives return their members' equity in a period longer than eight years since only one Nourse II cooperative has a revolving plan returning members' equity in less than seven years.

Only two Sapiro II cooperatives use a base capital plan, while the rest use either a first-in-first-out or a percentage-of-all-equities plan. Sapiro II's, generally return

members equity faster than Nourse I or Nourse II cooperatives: only 20% have revolving periods longer than thirteen years (Table 5.34). This divergence may be the result of differences in the nature of businesses in which Nourse and Sapiro cooperatives are involved, such as differences in the speed with which investments return profits.

Sapiro III cooperatives return their members' equity faster than any other type of cooperative in the sample. Most Sapiro III cooperatives use a base capital plan (fifteen out of nineteen that use any type of redemption program). The majority of these cooperatives (73%) return members' equity within five years (Table 5.35) while the four Sapiro III cooperatives adopting a traditional plan, have revolving periods of one to seven years.

Table 5.30. Frequency of the Various Types of Equity Redemption Plan Adopted by Responding Cooperatives—1998

	Frequency	Percent
Traditional Revolving Fund Plan	49	51.0%
Base Capital Plan	16	16.7%
Percentage-of-all-Equities Plan	5	4.2
Special Situation Plan*	27	28.1%
Total	97	100.0%

*Cooperatives that use only a special situation plan are included; not those that use a special situation plan in combination with another plan.

Table 5.31. Length of Revolving Period for the Equity Redemption Plan in Responding Cooperatives—1998

	Frequency	Percent
1 to 7 Years	22	24.7%
8 to 13 Years	33	37.1%
14 to 20 Years	17	19.1%
20 Years or More	17	19.1%
Total	89	100.0%

Table 5.32. Length of Revolving Period for the Equity Redemption Plan in Responding Nourse I Cooperatives—1998

	Frequency	Percent
1 to 7 Years	4	11.4%
8 to 13 Years	10	28.6%
14 to 20 Years	11	31.4%
20 Years or More	10	28.6%
Total	35	100.0%

Table 5.33. Length of Revolving Period for the Equity Redemption Plan in Responding Nourse II Cooperatives—1998

	Frequency	Percent
1 to 7 Years	1	16.7%
8 to 13 Years	3	50.0%
14 to 20 Years	0	0.0%
20 Years or More	2	33.3%
Total	6	100.0%

Table 5.34. Length of Revolving Period for the Equity Redemption Plan in Responding Sapiro II Cooperatives—1998

	Frequency	Percent
1 to 7 Years	9	36.0%
8 to 13 Years	11	44.0%
14 to 20 Years	2	8.0%
20 Years or More	3	12.0%
Total	25	100.0%

Table 5.35. Length of Revolving Period for the Base Capital Plan in Responding Sapiro III Cooperatives—1998

	Frequency	Percent
1 to 5 Years	11	73.3%
6 to 10 Years	4	26.7%
Total	15	100.0%

When do members lose their voting rights in the cooperative? The answer to this question gives an idea of how intense the horizon constraint might be. This is because when inactive members maintain their voting rights, they have an incentive to vote down any type of investment, and particularly those investments that are risky and may inhibit the cooperative's ability to return their perceived[55] equity investment. If this tendency is considered together with the previously mentioned result, namely that a large number of cooperatives have not adopted effective equity redemption plans, the intensity of the

[55] There is still debate on whether retains are really equity, or members' contribution.

problem may be more easily understood. In almost 43% of the cooperatives, members do not lose their right to vote until long after they have stopped patronizing the cooperative (Table 5.36). As a result, decisions affecting the long-term growth of the cooperative may be frequently left in the hands of those members who do not perceive a benefit in such growth.

Table 5.36. Period After Which Inactive Members Lose their Voting Rights in Responding Cooperatives—1998

	Frequency	Percent
After Being Inactive for One Year	28	25.5%
After Being Inactive for Two Years	20	18.2%
After All Patronage Refunds Have Been Redeemed	15	13.6%
Other[a]	47	42.7%
Total	110	100.0%

[a] Mainly, Never

Transferability of cooperative shares was also proposed as a remedy for the free rider constraint, especially when shares can be transferred not only between members of the cooperative but to non-members as well. It was also argued, that the semi-liquid characteristics of the secondary market created in this way, help ameliorate the free rider constraint.

Transferability of cooperative shares becomes part of the solution for the horizon constraint if shares are also appreciable, because it allows inactive members and members near the end of their patronage horizon, to retrieve a portion of their equity capital

through the sale of their equity stock. That is, the present value of the cooperative's estimated future income stream becomes capitalized into the value of the stock or delivery right and thus, investments perceived as good should increase the value of the equity shares, while the opposite is true for the investments deemed as bad.

With the creation of a semi-liquid market for equity shares comes the ability of members to realize increases in the cooperative's value when they liquidate their shares and thus the horizon constraint is partially removed. As shown in Table 8.9 (p. 6), 44% of the responding cooperatives allow transfer of their equity shares to outsiders, with the majority of them (27 out of 28[56]) being Sapiro III cooperatives. This group of Sapiro cooperatives completely coincides with the group of cooperatives with appreciable shares, since no cooperative was found to allow transfer of its shares without those shares being appreciable/depreciable.

Descriptive and Inferential Statistics Related to the Portfolio Constraint

The portfolio constraint refers to the inability of members to achieve their desired level of risk, with respect to their portfolios of cooperative assets. Consequently, members who are forced to accept more risk (e.g., through pooling, risky investments, etc.) than they would otherwise prefer, will exert pressure on management and the Board of Directors to

[56] The only non-Sapiro III cooperative that allows transfer of its shares, in this group, possesses so many Sapiro III cooperative characteristics that it was difficult to classify it as a Sapiro II cooperative in the first place.

choose investments of lower risk, and consequently lower expected returns (hypothesis 12, chapter three).

While a general tendency for preferring lower risk investments was not found in CEO's answers[57], 32% of the CEOs who answered the question felt cooperative investments are less risky than those of IOFs (Table 5.37).

Table 5.37. CEO's Perceptions of Riskiness of Cooperative Investments Relative to IOF Investments in Responding Cooperatives—1998

	Frequency	Percent
Less Risky	37	32.4%
The Same	61	53.5%
More Risky	14	14.1%
Total	114	100%

χ^2=29.589 (d.f.=2), $\chi^2_{critical}$=5.991 (5%) and 9.210 (1%)

The highly significant chi-square (29.589, with 2 d.f.) indicates that most CEOs believe that investments by their cooperatives are as risky as those by comparable IOFs.

It was also hypothesized in chapter three (hypothesis 13), that cooperative members will be unwilling to support investments in activities unrelated to those currently pursued by their cooperatives. Contrary to this hypothesis, 67% of the responding CEO's maintain that their members do support such investments (Table 5.38). A possible explanation of this result is that members support investments to unrelated activities because they hope that such investments will generate profits and hence provide

[57] CEOs were asked to compare the risk associated with their cooperative's investments to the risk of investments undertaken by similar IOFs.

permanent capital and thus demand for risk capital provided by them will decrease. Supportive of this explanation is the relatively high percentage of members who have contributed less equity than that corresponding to their use of the cooperative (Table 5.39).

Table 5.38. CEO's Perception of Members' Acceptance of Investments Unrelated to Current Activities in Responding Cooperatives—1998

	Frequency	Percent
Members Accept	75	66.9%
Members Do Not Accept	26	23.2%
Other	11	9.9
Total	112	100%

χ^2=60.018 (d.f.=2), $\chi^2_{critical}$=5.991 (5%) and 9.210 (1%)

Although this is a statistically significant result (χ^2=60.018, with 2 d.f.), it should be contrasted to the percentage of members who have contributed less equity to their cooperative than their proportion of business. In the question posed to CFOs, 27% of the respondents replied that more than 40% of their members have contributed less equity than their proportion of business with the cooperative (Table 5.39). While this percentage may serve as an indication that members do not provide the risk capital required for these "unrelated to current activities" investments, in-person discussions with professionals knowledgeable of cooperative finance issues, revealed another probable

dimension of this result. That is, the high percentage of cooperatives in which more than 40% of the members have provided less equity than their proportion of business with the cooperative, may indicate that these cooperatives have more new members who are growing, than additional members who patronize less than their proportion.

Table 5.39. Percentage of Members that Have Contributed Less Equity than their Proportion of Business With the Cooperative in Responding Cooperatives--1998

	Frequency	Percent	Cumulative Percent
1% -- 10%	24	28.2%	28.2%
11% -- 15%	9	10.6%	38.8%
16% -- 20%	6	7.1%	45.9%
21% -- 30%	13	15.3%	61.2
31% -- 40%	10	11.8%	72.9%
40% or More	23	27.1%	100.0%
Total	85	100%	

Another characteristic of the property rights structure hypothesized to determine the seriousness of the portfolio constraint (see also the structural equation model results in the next section), refers to the adoption of separate capital pools (hypothesis 14, chapter three). The majority of cooperatives in this study (76%) do not use separate capital pools (Table 5.40). However, if single-purpose cooperatives (marketing one product or supplying a single input) are *de facto* considered the same as multi-purpose

cooperatives adopting separate capital pools, then, the percent of cooperatives adopting separate capital pools becomes higher.

Table 5.40. The Frequency of a Separate Equity Capital Pool Policy in Responding Cooperatives—1998

	Frequency	Percent
Common Equity Pool	89	76.0%
Separate Equity Pools	28	24.0%
Total	117	100%

Table 5.41. The Frequency of a Separate Equity Capital Pool Policy in Responding Sapiro II Cooperatives--1998

	Frequency	Percent
Common Equity Pool	25	73.5%
Separate Equity Pools	9	26.5%
Total	34	100%

Table 5.42. The Frequency of a Separate Equity Capital Pool Policy in Responding Sapiro III Cooperatives--1998

	Frequency	Percent
Common Equity Pool	0	0.0%
Separate Equity Pools	19	100.0%
Total	19	100%

Additionally, Sapiro II and III cooperatives were analyzed separately, and the results are reported in Tables 5.41 and 5.42, respectively. While only 26% of Sapiro II cooperatives adopt a separate equity capital pool, all Sapiro III cooperatives (100%) have independent equity pools for the different sub-groups of their members.

Transferability and appeciability of members' cooperative ownership rights were also hypothesized to ameliorate the portfolio constraint (hypothesis 5, chapter three). Measures of these characteristics can be found in Tables 5.7, 5.8, and 5.9, presented earlier in this chapter.

Finally, hypothesis 15 stated that the payment of interest on members' allocated equity capital can, to some extent, ameliorate the negative impact of the portfolio constraint. However, from the 111 cooperatives that have answered the corresponding question, only 3% pay interest on members' allocated equity (Table 5.43).

Table 5.43. The Frequency of Payment of Interest Rate on Members' Allocated Equity Capital in US Agricultural Cooperatives--1998

	Frequency	Percent
No	108	97.3%
Yes	3	2.7%
Total	111	100%

A Latent Variable Model of the Investment Property Rights Constraints

Step One: Developing the Conceptual Model

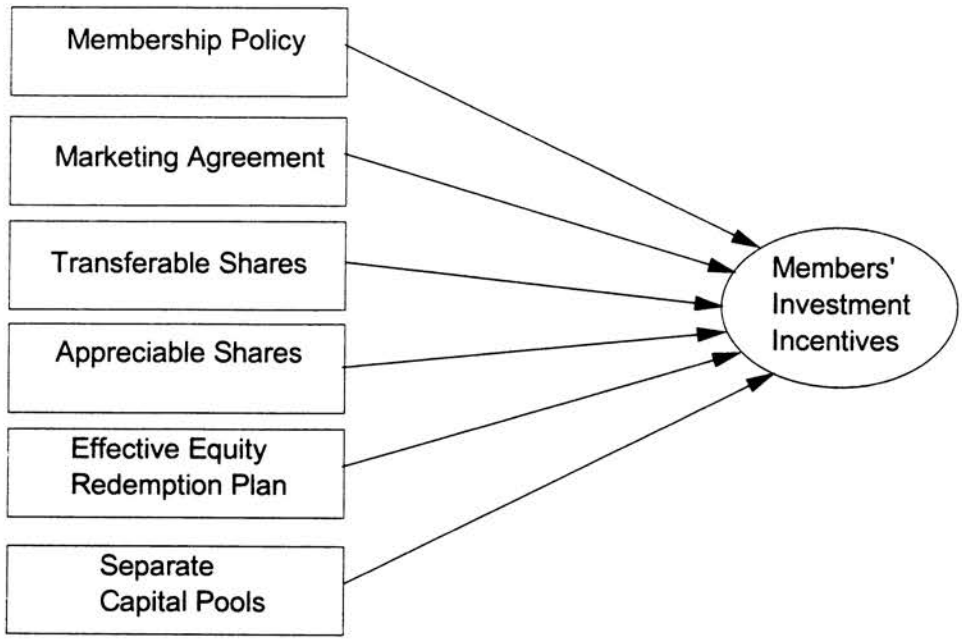
In chapter three, the discussion of the three investment property rights[58] constraints, identified six property rights characteristics that affect members' incentives to invest in their cooperatives:

1. Membership policy: whether the cooperative has an open or a defined membership policy.
2. Marketing agreement: whether members sign a marketing or a uniform grower agreement to supply the cooperative with a specific volume of a product, or buy a specific volume of agricultural supplies from the cooperative.
3. Transferable equity shares or delivery rights.
4. Appreciable equity shares or delivery rights.
5. Effective equity redemption plan: whether the cooperative returns members' equity capital in less than seven years.
6. Separate capital pools: whether the equity of the various sub-groups of members is kept in separate accounts, used to finance investments that provide benefits to the specific sub-groups.

Figure 5.2 Illustrates the hypothesized theoretical relationships between the above property rights characteristics and members' investment incentives.

[58] The free rider, the horizon, and portfolio constraints.

Figure 5.2. Investment Property Rights Constraints
in US Agricultural Cooperatives : The Conceptual Model



In this figure, the property rights determinants have been put into squares implying that they are empirically measurable, while "Members' Investment Incentives" are not directly measurable and thus have been enclosed in an ellipse.

Step Two: Constructing a Path Diagram of Causal Relationships

The conceptual model (Figure 5.2) was used to produce a path diagram of causal relationships between the theoretically proposed variables. Before drawing the path diagram, the nature of causality between the variables is studied in more detail. According to Bollen (1989), three conditions must be satisfied for causality to be established: (1) pseudo-isolation, (2) association, and (3) establishment of the direction of

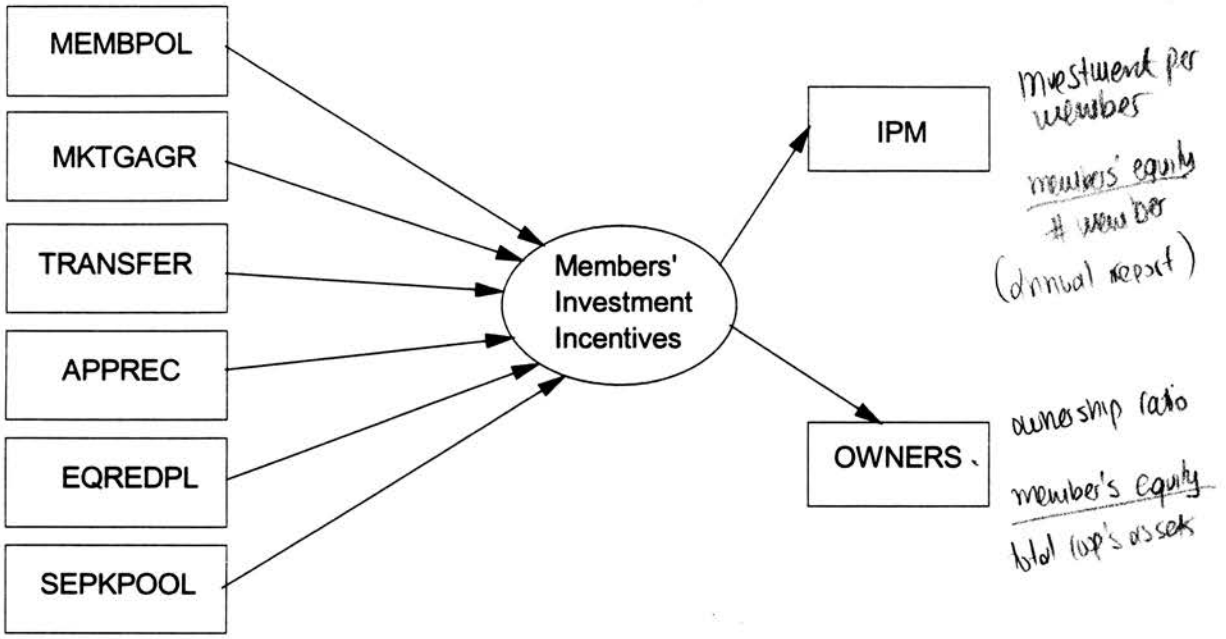
causality. Each of these conditions is necessary but not sufficient by itself. Pseudo-isolation refers to the assumption that the disturbance (i.e., the composite of all omitted determinants) is uncorrelated with the exogenous variables of an equation. Pseudo-isolation is usually violated when important exogenous variables, that are part of the error term, are omitted from a model and as a result, error term estimation is highly biased. Other cases where the condition of pseudo-isolation is violated include measurement errors, nonrandom sample selection, and correlated disturbances. A structural model research design can effectively solve problems related to measurement errors and correlated disturbances. The problem of omitted variables can only be overcome when a sound theory underlies the proposed model.

Association, the second condition for establishing causality, refers to whether a causal variable is associated to an effect variable after the two are pseudo-isolated. Sampling fluctuations are one threat to assessing associations even when an equation is correct. Other problems are created when the standard errors and test statistics are biased due to uncorrected problems of heteroskedastic disturbances or measurement errors. Replication of an association in an independent sample is one means to increase confidence that an association is robust.

Finally, the direction of causality must be established. Knowing that one variable precedes another in time is probably the single most effective means of doing so, but as Bollen illustrates (Bollen 1989, pp. 64-66), this does not always work nor is it always clear that temporal priority is met (e.g., in models with latent variables and indicators).

Based on the conceptual model of Figure 5.2, a path diagram depicting the hypothesized relationships between variables is shown in Figure 5.3.

Figure 5.3. Investment Property Rights Constraints in US Agricultural Cooperatives : The Path Diagram



The variables on the left-hand side of the diagram are independent exogenous variables that measure the property rights characteristics hypothesized to affect members' investment incentives. "Members' Investment Incentives" is a theoretical, unobservable construct (latent variable), indicated by two dependent observed variables. "IPM" stands for investment per member, which was defined as the ratio of members' equity to number of members and was calculated from the annual reports of the 127 US agricultural cooperatives that responded to the survey and provided data on the independent variables.

A portion of members' incentive to invest in their cooperative can be attributed to the relative attractiveness of the specific industry in which the cooperative operates. To avoid accounting for that portion and thus considering the net effect of the property rights constraints on the investment behavior of cooperative members, IPM was multiplied by the average industry turnover for the respective industry and the result was extracted from IPM.

"OWNERS" stands for ownership ratio, which is calculated by dividing members' equity to total cooperative assets and measures the degree to which members own the cooperative business. These two dependent variables were chosen as most indicative of members' willingness to invest in their cooperative. Investment per member (IPM) and the ownership ratio (OWNERS) are both solvency ratios that measure long-term financial health and stability. Other types of financial ratios regularly computed by USDA and CoBank for US agricultural cooperatives are efficiency, profitability, and liquidity ratios. Profitability ratios measure the ability to generate savings; liquidity ratios measure short-term cash flow ability; and efficiency ratios measure how well things are done. Due to their nature, solvency ratios are better suited to indicate changes in the way cooperatives finance their investments, and thus to suggest changes in members' incentives to contribute to the long-term financial health and stability of their organizations. Tables 5.44 and 5.45 provide descriptive statistics on these two variables.

Table 5.44. Investment Per Member (= Members' Equity/Number of Members) for US Agricultural Cooperatives – 1998

Amount ($)	Frequency	Percent
0 - 1,000	23	18.11%
1,001 - 3,000	29	22.83%
3,001 - 5,000	12	9.45%
5,001 - 10,000	19	14.96%
10,001 - 20,000	14	11.02%
20,001 - 50,000	23	18.11%
> 50,000	7	5.52%
Total	127	100%

Mean = 7,243.41, St. Dev. = 19,803.54, Range = 90, 645.48

Table 5.45. Ownership Ratio (= Members' Equity/Total Assets) for US Agricultural Cooperatives – 1998

Percentage	Frequency	Percent
0 - 15%	15	11.81%
15% - 35%	35	27.55%
35% - 50%	52	40.94%
50% - 65%	17	13.38%
65% - 100%	8	6.32%
Total	127	100%

Mean = 37.18%, St. Dev. = 18.32, Range = 85.25

Other solvency ratios proposed by CoBank (1994) and USDA (1996) for analyzing cooperative firms, include the local leverage ratio, and the term debt to fixed assets ratio. The local leverage ratio measures the ability of a cooperative to generate cash flows to cover long-term obligations, but refers only to local cooperatives and thus it was not used. The term-debt to fixed assets ratio measures the relationship between long-term debt and fixed assets. It indicates whether term debt is used to finance fixed assets or other items, such as working capital and if long-term debt has been repaid in accordance with the expected life of fixed assets. While this ratio could also be used as a dependent observed variable in the model, none of the calculated correlations between this ratio and the other observed variables exceeded ± 0.002, and thus it was decided to use only "IPM" and "OWNERS" as indicators of Members' Investment Incentives.

While the use of two indicators of MINVINC suffices for purposes of identification of the model, in an ideal modeling of members' investment incentives additional indicators would be desirable. Since however the results of structural equation models cannot be used as deterministic estimates, unless several estimations of the same coefficients for different samples have been made, the lack of additional indicators does not create serious problems in the interpretation of the results. Another issue arising from the use of the specific indicators (IPM and OWNERS) is related to whether they measure what they are supposed to measure. This is the problem of validity, discussed later in this chapter.

A different disadvantage of using IPM and OWNERS is that they do not account for any investment incentives provided to outsider investors. However, since this study

focuses exclusively on members' incentives this is not considered to be a serious problem.

Before further discussing the path diagram, a note on causality is justified. As discussed earlier, three conditions must be met to establish causality of which pseudo-isolation is the most difficult to satisfy. The approach used here was to include in the model all exogenous variables that were theoretically justified and then proceed with testing association and direction of causality. However, since only those cooperatives allowing transferability of their shares or delivery rights had shares or delivery rights with the potential to appreciate/depreciate, these two variables were treated as a single variable (TRANSFER) to avoid multicollinearity problems. Also, since it was expected that the errors in independent variables would be highly correlated, a structural equation model was preferred to simple regression techniques, because of its ability to deal with the existence of such correlation and provide robust estimates of the underlying relationships.

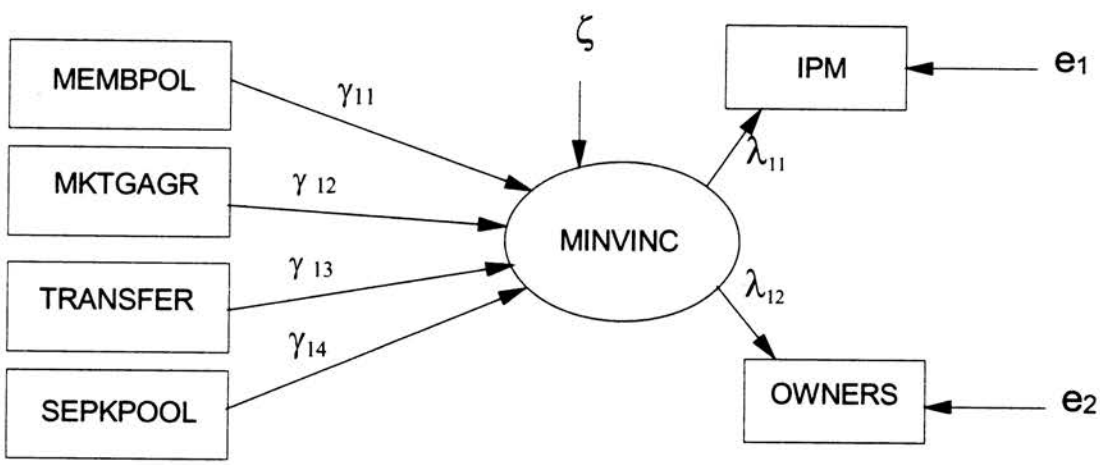
Next, the associations between independent and dependent variables were tested by means of calculating their correlation matrix. Since the independent variables were all dichotomous, the estimated correlation matrix included the tetrachoric correlations between dichotomous variables and biserial correlation between dichotomous and continuous (IPM, OWNERS) variables, as suggested by several authors (e.g., Bollen 1989). The obtained correlation matrix indicated a very weak association between EQREDPL and all other variables (Table 5.46). SEPKPOOL was significant, but only at the 0.01 level.

Table 5.46. Investment Property Rights Constraints – Biserial Correlations Between EQREDPL and the Other Observed Variables

	MEMBPOL	MKTGAGR	TRANSFER	SEPKPOOL	IPM	OWNERS
EQREDPL	0.021	0.009	-0.073	0.019	0.006	0.089

Direction of causality was established based on temporal priority. In Bollen's terminology, all exogenous independent variables (X's) were cause indicators of the latent variable (MINVINC) rather than effect indicators. In other words, the property rights characteristics cause a change in members' investment incentives, rather than the opposite. After establishing causality, a revised path diagram was constructed (Figure 5.4).

Figure 5.4. Investment Property Rights Constraints
in US Agricultural Cooperatives :
Path Diagram with Coefficients to be Estimated



Not shown in Diagram 5.4 are the intercorrelated errors in measuring the exogenous independent variables, the errors in measuring the endogenous dependent variables, and the error in measuring the latent variable MINVINC.

Step Three: Converting the Path Diagram into a Set of Equations

The next step was to specify a model in more formal terms through a series of equations that define: (1) the structural equations linking the constructs, (2) the measurement model specifying which variables measure (in this model, cause) which constructs, and (3) a set of matrices indicating any hypothesized correlations among constructs (latent variables) and observed variables. For the model depicted in Figure 5.4, these equations were:

$$\boldsymbol{\eta} = \boldsymbol{\Gamma}\mathbf{x} + \boldsymbol{\zeta} \qquad (5.1)$$

$$\mathbf{y} = \boldsymbol{\Lambda}_y\boldsymbol{\eta} + \boldsymbol{\varepsilon} \qquad (5.2)$$

where $\boldsymbol{\eta}$ is the 1x1 matrix endogenous dependent latent variables (MINVINC); $\boldsymbol{\Gamma}$ is the 1x4 matrix of coefficients linking the exogenous observed variables to the latent variable; $\mathbf{x}$ is the 4x1 matrix of exogenous observed variables; $\boldsymbol{\zeta}$ is the 1x1 matrix of the error in latent variable; $\mathbf{y}$ is the 1x2 matrix of endogenous observed indicators (IPM, and OWNERS) of the latent variable $\boldsymbol{\eta}$; $\boldsymbol{\Lambda}_y$ is the 1x2 matrix that contains the coefficients linking the latent variable to its indicators; and $\boldsymbol{\varepsilon}$ is the 1x2 matrix of the errors in measuring the observed endogenous variables.

Four additional matrices need to be defined before the model is fully specified. Θ_ε is the 2x2 matrix of prediction errors for indicators of endogenous constructs, with only one non-zero element in this case, while Θ_δ is the 4x4 matrix of prediction errors for the cause indicators of the latent variable. Φ is the matrix of correlations among exogenous latent variables, which in this model has all its elements equal to zero, since no exogenous latent variable is included in the model. Finally, Ψ is the 1x1 matrix of correlations between endogenous latent variables; in this case, it has only one element, $\psi = \mathrm{Var}(\zeta)$. This specification of the model is used when the computer program is created for estimating the proposed empirical model.

Once the model was specified, the next step was to assess the validity and reliability of the indicators. Validity of a measure x_i of ξ_j is the magnitude of the direct structural relation between ξ_j and x_i (Bollen 1989, p. 197). According to this definition, for a measure to be valid, the latent and observed variable must have a direct link. The single most easy to compute measure of validity is the unstandardized validity coefficient (λ), proposed by Bollen (1989). These coefficients are simply the estimated coefficients included in the Γ and Λ_y matrices and are estimated later in this chapter, and an assessment of validity is also provided.

While validity is a concept that applies to both effect and cause indicators, reliability does not apply to cause indicators. Reliability is the squared correlation of a measure and its latent variable. In the case of exogenous cause indicators, as is the case with the model hypothesized here, reliability is zero, by the very definition of

"exogenous" (Bollen 1989, p. 222). Measures of reliability for the case of cause indicators have not yet been developed in the statistic literature.

Step Four: Choosing the Input Matrix Type and Identifying the Model

Before deciding on the type of the input matrix to be used, the observed continuous variables were inspected for outliers. PRELIS 2.0® was used for this purpose and no outliers were found[59]. Additionally, the data on the continuous variables (IPM, and OWNERS) were inspected for divergence from normality, and excessive kurtosis and skewness. Both IPM and OWNERS were found to have negative skewness and kurtosis. According to West et al. (1995, p. 71) a logarithmic transformation of the variable may solve the problem. After taking the natural logarithm of IPM and OWNERS, a new test for skewness and kurtosis was conducted. PRELIS 2.0® performs the test for skewness and kurtosis proposed by D'Agostino (1986, p. 391), where the value of the computed test statistic (K^2) approximates a chi-square distribution with two degrees of freedom. The critical values for two degrees of freedom are 5.991 (at the 0.05 level of significance) and 9.210 (at the 0.01 level of significance). As shown in Table 5.47, after the transformation, both variables approximated the normal distribution; IPM at the 0.05 level of significance and OWNERS at the 0.01 level of significance.

[59] PRELIS 2.0 was used to create a scatterplot of IPM against OWNERS, and visual inspection for outliers was performed.

Table 5.47. K^2-test for Skewness and Kurtosis for Continuous Variables		
	IPM	OWNERS
K^2 -statistic(χ^2 with 2 d.f.)	3.546	8.920
$\chi^2_{CRITICAL}$ = 5.991 (at 0.05) and 9.210 (at 0.01)		

While the use of the variance/covariance matrix of all observed variables in the model allows the researcher to better validate causal relationships it also has a major drawback, which makes it unattractive. It is difficult to interpret the results because the coefficients must be interpreted in terms of the units of measure of the constructs. Correlation matrices, on the other hand, have a common range that makes possible direct comparisons of the coefficients within the model. Moreover, research has shown that the correlation matrix provides more conservative estimates of the significance of coefficients and is not upwardly biased as previously thought (Dillon et al. 1987).

Considering these advantages of the correlation matrix, it was used as input for estimating the model. However, since all exogenous observed variables (X's) are dichotomous variables the Pearson product-moment correlation is inappropriate (Hair et al. 1995, p. 637). To allow for incorporation of the non-metric measures into the structural model, different types of correlations were calculated. When both variables were dichotomous (for example MEMBPOL and TRANSFER), the tetrachoric correlation between these variables was calculated. When one variable was dichotomous, while the other was continuous, the biserial correlation of the variables was computed. The correlation matrix was calculated with PRELIS 2.0® and was stored in a file, to be used in the estimation of the model.

While there is no correct sample size, a sample of more than 100 observations has been proposed as adequate. For this model 127 observations were used to estimate the parameters. The computed matrix of polychoric correlations between observed variables is shown in Table 5.48.

Table 5.48. Polychoric Correlation Matrix to be Analyzed: Investment Property Rights Constraints Model

	MEMBPOL	MKTGAGR	TRANSFER	SEPKPOOL	IPM	OWNERS
MEMBPOL	1.00					
MKTGAGR	-0.7728	1.00				
TRANSFER	-0.7995	0.6565	1.00			
SEPKPOOL	-0.5346	0.6618	0.5145	1.00		
IPM	-0.9376	0.8091	0.7557	0.4963	1.00	
OWNERS	-0.9681	0.8725	0.7809	0.5732	0.7432	1.00

LISREL 8.0, Interactive for Windows® was the software chosen for estimating the model. While several software programs are now available for structural equation models, LISREL is still the most widely used software and, in its new interactive edition for windows, it has become more user-friendly than its earlier versions by including a wide range of alternative methods of estimation and model evaluation.

Following Bollen (1989, p. 425), when non-normality threatens the validity of the widely used maximum likelihood estimator it is wiser to employ an alternative estimator that allows for non-normality and is asymptotically efficient. The weighted least squares (WLS) estimator is the one proposed by several authors for use in such cases (e.g., Bollen 1989, p. 425; Wothke 1993, p. 257), and its fitting function is:

$$F_{WLS} = [s - \sigma(\vartheta)]' W^{-1} [s - \sigma(\vartheta)] \qquad (5.3)$$

where **s** is a vector of ½ (p+q) (p+q+1) elements obtained by the non-duplicated elements of **S** in a vector, $\boldsymbol{\sigma(\theta)}$ is the corresponding same-order vector of $\boldsymbol{\Sigma(\theta)}$, and $\boldsymbol{\theta}$ is the tx1 vector of free parameters. The $\mathbf{W}^{-1}$ is ½ (p+q) (p+q+1) x ½ (p+q) (p+q+1) positive-definite weights matrix. Values of $\boldsymbol{\theta}$ are selected so as to minimize the weighted sum of squared deviations of **s** from $\boldsymbol{\sigma(\theta)}$.This is analogous to weighted least squares regression analysis where a weighted, squared difference between the observed and predicted dependent variable is minimized by the selection of regression coefficients. In WLS however, the observed and predicted values are covariances rather than individual values. The correct weight matrix to be used is the asymptotic covariance matrix of the observed variables. This asymptotic covariance matrix was calculated with PRELIS 2.0® and was stored in a file to be used in conjunction with the correlation matrix in parameter estimation. The major advantage of the WLS estimator is that it does not assume that variables are multinormally distributed, a condition necessary for using any of the maximum likelihood, generalized or unweighted least square methods.

After choosing the method of estimation, the model must be identified[60]. That is, it must have positive degrees of freedom. The degrees of freedom for the proposed model were calculated as:

$$d.f = \tfrac{1}{2}(p+q)(p+q+1) - t = \tfrac{1}{2}(4+2)(4+2+1) - 16 = 5,$$

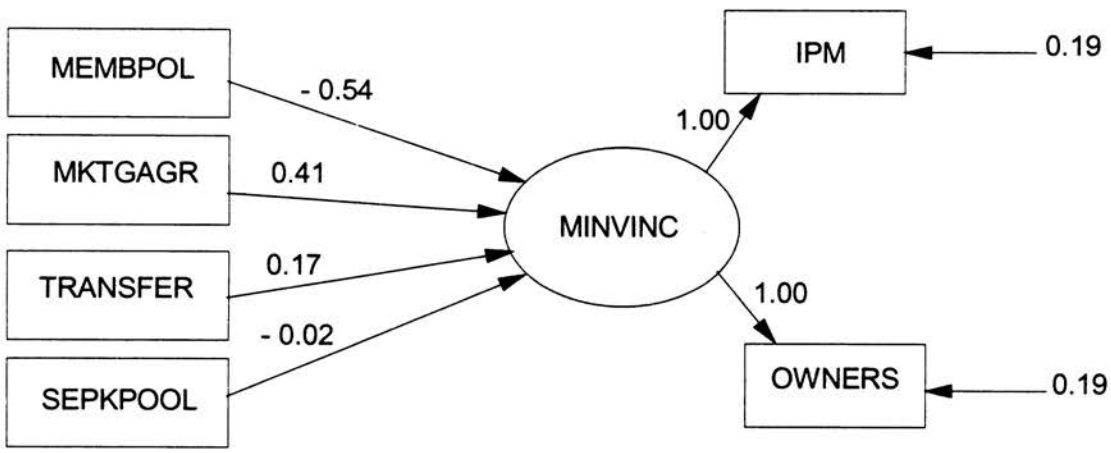
[60] See Appendix Three.

where p and q are the number of independent and dependent observed variables, respectively, and t is the number of parameters to be estimated[61]. The paths from the latent variable to its indicators have been set to one, under the assumption that the two dependent observed variables are reasonably accurate indicators of members' investment incentives. All other parameters were estimated within the model.

Step Five: Estimating the Model

As previously mentioned, LISREL 8.0 Interactive for Windows® was used to estimate the model. The obtained results are shown on the arrows connecting the variables in the following path diagram (Figure 5.5), which is a reproduction of Figure 5.4.

Figure 5.5. Investment Property Rights Constraints in US Agricultural Cooperatives : Path Diagram with Estimated Coefficients: Model H1



[61] The parameters to be estimated include the correlations between the measurement errors of the observed independent variables. They do not include the coefficients that have been normalized.

A more detailed presentation of the estimates is included in Table 5.49. Appendices four and five contain the LISREL input files for the estimation of the model, and the output files with the results.

Table 5.49. Investment Property Rights Constraints Model H_1-- WLS Estimates

Parameter	Coefficient Estimate	St. error	t-value
γ_{11}	- 0.54	0.13	- 4.18
γ_{12}	0.41	0.15	2.81
γ_{13}	0.17	0.11	1.52
γ_{14}	- 0.02	0.07	- 0.36
λ_{11}	1.00[a]	--	--
λ_{12}	1.00[a]	--	--

$\chi^2 = 9.38$, χ^2 Critical= 11.070 (5%)
d.f. = 5
P = 0.09467
RMSEA = 0.083

[a] Parameters constrained through normalization

Step Six: Evaluating Goodness-of-Fit Criteria

Evaluation of the obtained results started with a check for offending estimates. These are estimated coefficients in either the structural or measurement models that exceed acceptable limits and the most common examples of offending estimates are: (1) negative error variances or non-significant error variances for any construct, (2) standardized coefficients exceeding or very close to 1.00, or (3) very large standard errors. As can be seen in Table 5.51 above and in Appendix Five, no offending estimates were obtained from the model estimation.

The next step was to evaluate model fit. Three types of measures for assessing model fit have been proposed in the literature on structural equation models: absolute fit, incremental model fit, and parsimonious fit measures. For a more detailed description of the types of measures for evaluating model fit, the reader is referred to Appendix Three. The standard approach in evaluating model fit is to report more than one measures from each of the categories of measures (Table 5.50).

Table 5.50. Goodness-of-fit Measures for Investment Property Rights Constraints Model (H_1)

Measures of Absolute Fit	Acceptable Range
Chi-square (χ_2) Statistic = 9.38 (5 d.f.)	Less than 11.07 (at 0.05 level of significance)
Goodness-of-fit Index (GFI) = 0.9972	As close to 1.00 as possible
Adjusted GFI = 0.9883	As close to 1.00 as possible
RMSEA = 0.08	0.05 - 0.08
Measures of Incremental Fit	**Acceptable Range**
AGFI = 0.9883	As close to 1.00 as possible
Normed Fit Index = 0.9972	As close to 1.00 as possible

Measures of Absolute Fit

The absolute fit measures assess only the overall model fit (both structural and measurement models collectively), with no adjustment for the degree of "overfitting" that might occur. LISREL computes the following absolute fit measures:

1. Likelihood Ratio Chi-square (χ^2) Statistic: Joreskog and Sorbom (1996) emphasize that χ^2 should not be regarded as a test statistic but rather as a goodness-of-fit (or badness-of-fit) measure; large χ^2-values correspond to bad fit and small χ^2-values to good fit. Degrees of freedom serve as a standard by which to assess the magnitude of χ^2. That is, by comparing the obtained chi-square to a critical one and for the corresponding

degrees of freedom, the model is said to have a good fit if the critical value of the table significantly exceeds the chi-square for the model. For the estimated model, chi-square was 9.38, while the critical value of chi-square for 5 degrees of freedom is 11.070 at the .05 level of significance, and 15.086 at the .01 level of significance. Therefore, the estimated model fits very well the data at hand. Additionally, the low chi-square values, which result in significance levels greater than 0.05 or 0.01, indicate that the actual and predicted input matrices are not statistically different. LISREL generated a significance level of 0.094, which indicates that the hypothesized model describes the observed data in an accurate way.

2. Goodness-of-Fit (GFI) and Adjusted Goodness-of-Fit (AGFI) Indices: The GFI is defined as:

$$GFI = 1 - \frac{\left(s - \hat{\sigma}\right) W^{-1} \left(s - \hat{\sigma}\right)}{s' W^{-1} s} \qquad (5.4)$$

The numerator in 5.4 is the minimum of the fit function after the model has been fitted; the denominator is the fit function before any model has been fitted.

The GFI adjusted for degrees of freedom, or AGFI is defined as:

$$AGFI = 1 - \frac{(p+q)(p+q+1)}{2d.f.}(1 - GFI) \qquad (5.5)$$

Both of these measures should be between zero and one, with zero indicating no fit and one indicating perfect fit. For the model at hand GFI was estimated to be equal to 0.9972, and AGFI equal to 0.9883, both indicating a very good absolute model fit.

3. Root Mean Square Error of Approximation (RMSEA): This measure of absolute fit shows how much better the model would fit the data if the population, instead of a sample, was used for the estimation with values ranging from 0.05 to 0.08 deemed as acceptable. For the estimated investment property rights constraints model an acceptable 0.08 RMSEA was computed by LISREL.

Measures of Incremental Fit

This class of measures compares the proposed model to some baseline model, most often referred to as the "null model" which should be some realistic model that all other models are expected to exceed. In most cases, the null model is a single-construct model with all indicators perfectly measuring the construct. Several measures can be used to assess the incremental fit of a model but most of them can be used only for comparison between two models.

1. Adjusted Goodness-of-Fit Index (AGFI): A recommended acceptance level is a value greater than or equal to 0.90. As previously reported for the investment constraints, model AGFI was 0.9883.

2. Normed Fit Index (NFI): One of the most popular measures is the NFI, which ranges from zero (no fit at all) to 1.0 (perfect fit) and provides a relative comparison of the proposed model to the null model. The NFI is calculated by:

$$NFI = (\chi^2_{NULL} - \chi^2_{PROPOSED}) / \chi^2_{NULL}$$

While there is no absolute value indicating an acceptable level of fit, a commonly recommended value is 0.90 or greater. The NFI for the estimated model was calculated to be 0.9972.

Measures of Parsimonious Fit

These measures relate the goodness-of-fit of the model to the number of estimated coefficients required to achieve this level of fit and their basic objective is to diagnose whether model fit has been achieved by "over fitting" the data with too many coefficients. This procedure is similar to the "adjustment" of the R in multiple regression. However, since no statistical test is available for these measures, their use in an absolute sense is limited, in most instances, to comparisons between models and thus they are not reported here but are included in the LISREL output, in Appendix Five.

Step Seven: Interpreting and Modifying the Model

After assessing model fit, it is critical to consider any possible modification of the model that would improve model fit. The first indication for model improvements comes from

examination of the residuals of the predicted correlation matrix. Residual values greater than ± 2.58 are considered to be statistically significant at the 0.05 level. Significant residuals indicate a substantial prediction error for a pair of indicators (i.e., one of the pair of correlation in the original input data) but for the model estimated earlier, the largest fitted residual was 0.1606, indicating no such problems.

Another aid in assessing the fit of a specified model is the modification indices, which are calculated by LISREL for each non-estimated relationship. The modification index values correspond approximately to the reduction in the chi-square that would occur if the coefficient had been estimated. A value of 3.84 or greater suggests that a statistically significant reduction in chi-square is obtained when the coefficient is estimated. However, Joreskog and Sorbom (1996) suggest that no change in the model should be made, unless it is theoretically justifiable. As can be seen in the LISREL output, in Appendix Five, no modification index exceeded 3.84 for the model at hand. However, the very low t-value for the coefficient $\gamma_{1\,4}$ (the path from SEPKPOOL to MINVINC) suggests that this parameter might be eliminated, leading to an alternative model with better fit.

To test the hypothesis that $\gamma_{1\,4} = 0$ (hypothesis H_0), versus the alternative hypothesis that $\gamma_{1\,4} \neq 0$, Joreskog and Sorbom (1996, p. 266) suggest several alternative methods. The simplest of these methods is to estimate the model first under H_0, and then under H_1. Let χ^2_0 and χ^2_1 be the associated chi-square statistics, and df_0 and df_1 the

respective degrees of freedom for the two models. Then, the difference of χ^2_0 and χ^2_1 (D^2), can be used as a χ^2-statistic with d (= df_0 - df_1) degrees of freedom.

For this model, H_1 ($\gamma_{1\,4} \neq 0$) is given by the model estimated above. To obtain H_0, $\gamma_{1\,4}$ was fixed, and the model was re-estimated. The obtained results are shown in Figure 5.6 and, in more detail, in Table 5.51.

Figure 5.6. Investment Property Rights Constraints
in US Agricultural Cooperatives :
Path Diagram with Estimated Coefficients: Model Ho

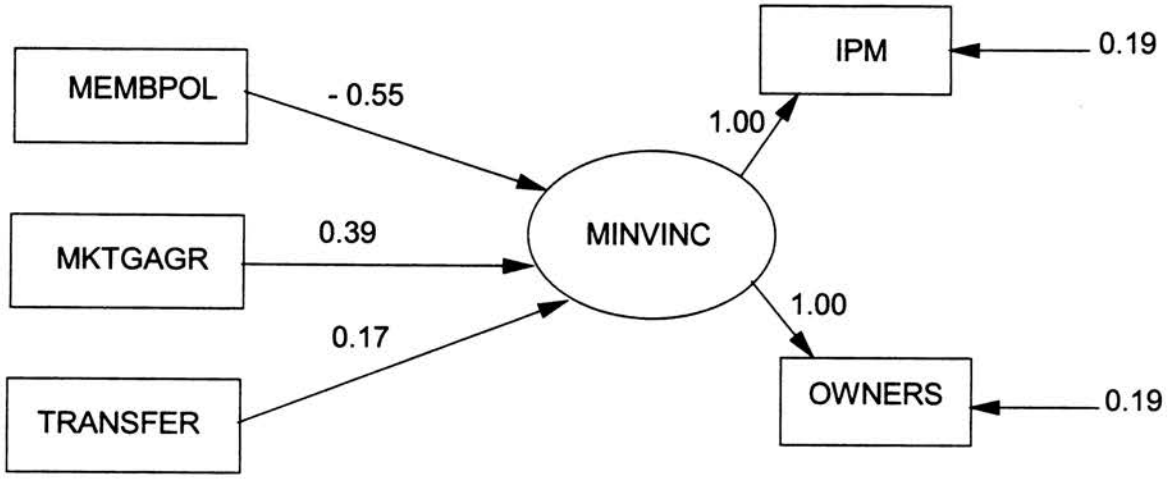


Table 5.51. Investment Property Rights Constraints Model H_0-- WLS Estimates

Parameter	Coefficient Estimate	St. error	t-value
γ_{11}	- 0.55	0.13	- 4.29
γ_{12}	0.39	0.12	3.23
γ_{13}	0.17	0.11	1.57
λ_{11}	1.00[a]	--	--
λ_{12}	1.00[a]	--	--

$\chi^2 = 9.54$, d.f. $= 6$, χ^2 Critical$= 12.592$ (5%)
P = 0.1455,
RMSEA = 0.06840

[a] Parameters constrained through normalization

The difference between the two chi-squares is computed as:

$$D^2 = \chi^2_0 - \chi^2_1 = 9.54 - 9.38 = 0.16, \text{ and}$$

$$d = df_o - df_1 = 6 - 5 = 1.$$

Since D^2 is not significant at neither the 0.05 nor the 0.01 levels of significance H_0 cannot be rejected, and hence $\gamma_{1\,4}$ cannot be assumed to be statistically different from zero.

The two models have the same goodness-of-fit indices, but when adjusted for degrees of freedom, the H_0 model has a better adjusted goodness-of-fit index (0.9901 > 0.9883). The two models have also the same normed fit index of 0.9972, indicating that any improvement in fit, is only incremental. However, the Probability associated with the H_0 model, is higher than the one of the H_1 model (0.1455 > 0.09467). Furthermore, a Root Mean Square Error of Approximation (RMSEA) equal to 0.0684 for the H_0 model, indicates a better fit for this model when compared to H_1 (RMSEA = 0.083).

Table 5.52. Goodness-of-fit Measures for Investment Property Rights Constraints Model (H_1)

Measures of Absolute Fit	Acceptable Range
Chi-square (χ_2) Statistic = 9.54 (6 d.f.)	Less than 12.592 (at 0.05 level of significance)
Goodness-of-fit Index (GFI) = 0.9972	As close to 1.00 as possible
Adjusted GFI = 0.9901	As close to 1.00 as possible
RMSEA = 0.0684	0.05 - 0.08
Measures of Incremental Fit	**Acceptable Range**
AGFI = 0.9883	As close to 1.00 as possible
Normed Fit Index = 0.9972	As close to 1.00 as possible

The obtained results and the assessment of the fit of the modified model suggest that the property right structures of US agricultural cooperatives affect significantly

members' incentive to invest in their organizations with the adopted membership policy being the most significant influence. The dichotomous variable MEMBPOL takes the value zero for cooperatives with a defined, or closed membership policy, and the value 1.0 for cooperatives with an open membership policy. The estimated coefficient of -0.55, connecting MEMBPOL to MINVINC indicates that, *ceteris paribus*, 55% of the variation in members' investment incentives can be attributed to variation in MEMBPOL. As a result, variation in the measurable indicators of members' investment incentives can also be explained in the same way, since their coefficients have been normalized and no indirect effects between variables have been assumed. Likewise, 39% of the variation in members' investment incentives is attributable to variation in members' commitment to the cooperative through an enforceable marketing agreement. Since the estimates for MEMBPOL (adopted membership policy) and MKTGAGR (adoption of marketing agreements between the cooperative and its members) are highly significant at the 0.05 level. However, TRANSFER (whether the cooperative has transferable and appreciable shares or delivery rights) is significant only at the 0.01 level.

At this point a note on the validity of observed variables is justified. As mentioned earlier, validity is the extent to which the indicators "accurately" measure what they are supposed to measure and according to Bollen (1989) good measures of validity that work in the case of cause indicators, are simply the estimated coefficients in the Λ_y and Γ matrices. For the model estimated above, the coefficients in Λ_y have been normalized to one, denoting the assumed high validity of IPM and Owners, as indicators of members' investment incentives. With respect to the coefficients in Γ, MEMBPOL

and MKTGAGR have relatively high estimated coefficients which indicate that they are valid measures of MINVINC. On the other hand, TRANSFER has a relatively small estimated coefficient and thus it cannot be assumed to explain a significant proportion of the observed variance in the dependent latent variable.

The relatively high percentage of variance in members' investment incentives attributed to variance in the adopted membership policy, justifies further discussion of this result. As explained earlier, membership policy can be either open or closed. The single most important aspect of a closed membership cooperative is that its management has a high degree of control over the volume of the commodity supplied by members[62]. Control of supply has been discussed in the cooperative literature (e.g., Hansmann 1996; Cook and Iliopoulos 1998) as an important determinant of success in management's ability to develop and implement an effective strategic plan, that would increase the profitability of the cooperative firm. Additionally, control of supply has been mentioned as a significant determinant of the degree of coordination between the combined productive endeavors of the cooperative and its members' individual businesses (Van Wassenaer 1989).

Marketing Agreements are also important in achieving the aforementioned goals of control of supply and coordination. The difference between the estimates of these two property rights characteristics may arise because of their different natures. That is, closed membership policy does not require the commitment of members' resources to the

[62] While the discussion focuses on marketing cooperatives, it can easily be extended to supply cooperatives. In supply cooperatives, it is rather an issue of control of members' demand for one or more agricultural supplies, than an issue of supply control.

cooperative goal[63] at least to the extent that a marketing agreement does. Marketing agreements usually require that a member supplies the cooperative for one or more seasons with a specific quantity of a commodity. As shown in the first part of this chapter, cooperatives that use marketing agreements also use severe penalties for members unable or unwilling to fulfill the pre-specified terms of the agreement. Therefore, members may prefer closed membership to a marketing agreement, as a mechanism for controlling supply and thus ameliorating the negative impact of the free rider constraint. Marketing agreements, especially in cooperatives with a small number of members, can seriously threaten trust between members and the cooperative and thus some cooperatives may not use them, even if they are effective mechanisms for achieving control of supply and coordination (Hansmann 1996).

While membership policy and marketing agreement both refer to members' commitment, the third independent variable (TRANSFER) is associated with another important issue. Transferability and appreciability of cooperative equity shares or delivery rights, are responsible for creating a semi-liquid secondary market for the cooperative's stock and thus these two property rights characteristics are proved to be relatively important tools for ameliorating the horizon problem. On the other hand, as suggested by the results, equity redemption plans do not significantly affect members' incentives to invest in their cooperative. A probable explanation is that, while they may succeed in aligning user and benefactor rights for investments that pay back within the

[63] Unless, of course, a significant up-front equity capital investment is required.

membership horizons of current members, they fail to do so for long-term investments (e.g., in intangible assets). Additionally, the effectiveness of equity redemption plans is determined, to a great extent, by conditions highly affected by exogenous events such as changes in the macro-economic environment and the characteristics of an industry.

Another explanation of the low importance of equity redemption plans is that they create a less liquid secondary market for cooperative ownership rights than the one formed by transferable and appreciable shares and thus they fail to provide investment incentives to members, with respect to long-term projects. On the other hand, transferable and appreciable rights allow the value of cooperative investment decisions to be depicted in their market price, in a way similar to that of IOF stock and hence are more effective means for solving the horizon problem.

Transferable and appreciable shares or delivery rights are also a way to deal with the portfolio problem because members' incentives to invest in their cooperative are enhanced when they can decide on the level of risk they assume. The statistical significance of this variable in the model reveals not only its importance in solving the free rider and horizon problems, but also in ameliorating the portfolio constraint. Another hypothesized solution to the portfolio constraint was the adoption of separate capital pools and while the impact of this variable was found insignificant one possible explanation is that since only a few cooperatives adopt separate capital pools, their positive effects could not be detected in the model. Alternatively, another explanation may involve the fact that separate capital pools are a relatively new accounting method

and as such it has not shown yet its positive impact on members' investment incentives, or that cooperatives do not make full use of its inherent advantages. Further investigation of the issues pertaining to the portfolio constraint, and more specifically to the adoption of separate capital pools is fully justified.

Concluding the interpretation of the obtained results, a simplistic example may be helpful in understanding the true impact of cooperative property rights characteristics on members' investment incentives. Suppose that all cooperatives in the sample had to choose to either invest in a new project or not. Suppose further, that members' investment incentive takes only two values: they are either willing to invest, or not. Then, in this oversimplified example, the members of those cooperatives that have a closed membership policy, use marketing agreements, and have transferable and appreciable shares, would choose to invest in the project. Members in open membership cooperatives, with no marketing agreements and non-transferable and non-appreciable shares, would not invest in the new project. While this example is not realistic, it provides a crude assessment of the importance of cooperative property rights characteristics in affecting the investment incentive facing members.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

In the previous chapters, the three vaguely defined property rights constraints–the free rider, the horizon, and the portfolio constraints— that significantly affect members' investment incentives were identified, theoretically analyzed, and empirically tested. The following conclusions are drawn with respect to goals of this study and recommendations made for future research.

Summary of Contributions and Hypotheses

Before synopsizing the hypotheses tested in this study a summary of the original contributions of this research follows:

1. Development of a neo-institutional economics theoretical framework for studying the investment vaguely defined property rights constraints.
2. Theoretical analysis of the investment vaguely defined property rights constraints within the aforementioned neo-institutional framework.
3. Empirical investigation of the investment property rights constraints and of the related hypotheses.
4. Detailed description, documentation, and summarization of the property rights—incentive—structures of both traditional and new generation forms of collective action firms.

5. Implications for the organization of agricultural cooperatives and for public policy makers.

The main hypothesis derived in the theoretical analysis of the property rights constraints postulated that the unique property rights characteristics of US agricultural cooperatives significantly affect members' investment incentives, and the efficiency of collective decision making (Table 6.1). The empirical analysis suggests that this hypothesis is fully supported and that alignment of residual control and residual claimant rights is necessary for enhancing members' investment incentives.

The developments in Neo-institutional Economics theory incorporated the property rights approach in the analysis of the cooperative firm thus making possible the study of previously undetected or neglected factors. Using this new theoretical framework it was possible to test empirically certain important hypotheses related to the affect of property rights on the cooperative firm (Table 6.1).

Table 6.1. Summary of Hypotheses		
Main Hypothesis		
H_0:	Cooperative principles, regulations, and bylaws, create and promote a traditional property rights structure, characterized by non-transferable, non-redeemable and limited time horizon residual claims, that results in misalignment of residual rights of control and residual claimant rights. This property rights structure does not provide cooperative members with the necessary incentives to invest in their organizations. On the other hand, new forms of collective action, in agriculture, designed to achieve a more efficient alignment of residual claimant and residual control rights, enhance members' willingness to invest risk capital in their organizations.	SUPPORTED
Hypotheses Related to the External Free Rider Constraint		
H_1:	Cooperative membership policy (open/closed) significantly affects the amount of equity capital invested by each member in the cooperative.	SUPPORTED
H_2:	Cooperative policies, such as marketing or uniform grower agreements, that increase members' pre-commitment to their cooperative, ameliorate the external free rider problem.	SUPPORTED
Hypotheses Related to the Internal Free Rider Constraint		
H_3:	In general, cooperative members favor decisions that increase total payments to each member.	SUPPORTED
H_4:	Restricted or closed membership policies are mostly observed in cooperatives where the effects of business decisions are fully captured in the cooperative's cash flows (e.g., through sale of a brand name product).	WEAKLY SUPPORTED

Table 6.1. Summary of Hypotheses (Continued)		
H_5:	Transferable and appreciable ownership rights help ameliorate the free rider constraint.	SUPPORTED
Hypotheses Related to the Horizon Constraint		
H_{5A}:	Transferable and appreciable ownership rights help ameliorate the horizon constraint.	SUPPORTED
H_6:	Cooperatives spend a low percentage of their operating budget on investments related to R&D and other intangible assets, such as advertising, compared to investor-oriented firms.	NOT SUPPORTED
H_7:	When the horizon constraint is not ameliorated, members pressure the Board and/or top management to: • Increase the proportion of the cooperative's cash flow devoted to current payments relative to investment. • Accelerate equity redemptions at the expense of retained earnings	SUPPORTED
H_8:	Cooperatives implementing an equity redemption plan with relatively short (less than seven years) period of equity revolvement, have a higher investment per member, than cooperatives that do not have any equity redemption plan, or have a plan of a long (more than seven years) revolving period.	NOT SUPPORTED
H_9:	Cooperatives are expected to borrow under conditions that place the repayment burden on future generations	SUPPORTED
H_{10}:	In general, cooperatives issue long-term bonds with low coupons, and no sinking-fund provisions, as current members attempt to shift risk from themselves to future generations of members	SUPPORTED

Table 6.1. Summary of Hypotheses (Continued)		
H_{11}:	Due to the horizon constraint, members pressure top management and the Board to liquidate their cooperative's assets, in whole or in part. This pressure is not intense in states where the incorporation statutes specify that in the case of total liquidation a cooperative's assets must be distributed among past as well as current patrons.	SUPPORTED
Hypotheses Related to the Portfolio Constraint		
H_{12}:	Cooperative members usually favor cooperative business decisions associated with lower levels of risk.	WEAKLY SUPPORTED
H_{13}:	Cooperative members are reluctant to support investments, by their cooperative, in business activities unrelated to those in which the cooperative is already involved.	NOT SUPPORTED
H_{14}:	In multi-purpose cooperatives with common equity capital pools, members invest less per member, than in those that operate separate capital pools.	SUPPORTED
H_{15}:	Payment of interest on members' allocated equity capital is expected to ameliorate, at least to some extent, the portfolio constraint.	NOT SUPPORTED

Implications for US Agricultural Cooperatives

The analysis of the vaguely defined property rights constraints presented in the previous chapters and the empirical tests of the generated hypotheses have several important implications for US agricultural cooperatives. Member investment incentives, investment portfolio management, and collective decision-making are three of the areas that are affected the most by the unique cooperative property rights structure.

Clearly defined property rights play a highly significant role in attracting new members to cooperatives. When the residual rights of control are aligned with residual claimant rights, non-members perceive a higher benefit in joining the cooperative. Furthermore, clearly defined property rights play a dual role, in attracting new members. Not only do they encourage outsiders to join, in order to have access to benefits provided only to members (e.g., the residual claim to the receipts from selling a value-added product), they also create incentives for those farmers who view the cooperative both as an outlet for their commodities,[64]and as an investment. Therefore, in Olson's terminology, policies aimed at creating such incentives for outsiders, can transform cooperatives, from latent groups to privileged ones[65]. For example, Sapiro II, marketing cooperatives, especially those marketing more than one product[66], could use investment incentive-enhancing policies, to minimize the number of external free riders.

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[64] Or as a way to buy agricultural inputs at a low price.
[65] See for example, Figure 4.1, in this volume.
[66] As discussed in chapter four, the external free rider constraint may affect such cooperatives more seriously than single commodity cooperatives.

Sapiro I, bargaining cooperatives could also use a similar approach if adequate institutional environment policies were in place. These policies may not be the same for each type of cooperative. The adoption of a closed membership policy is justified since cooperatives adopting this policy tend to create an environment with more positive rent seeking incentives for members to invest risk capital.

Enforced marketing agreements also tend to create investment incentives. These two policies, closed membership and marketing agreements, tie members and potential members to the cooperative and become even more important when the insider free rider constraint is considered. Aligning residual control and residual claimant rights ensure existing members, that net benefits resulting from their investments will be shared solely by them. Thus, existing members do not hesitate to invest in their cooperatives, since they alone capture the value of their investments.

The creation of a secondary market for cooperative shares and/or delivery rights provides an additional investment incentive-stimulating mechanism. When members can capture the market value of their investment decision by selling their residual claims to the cooperative's future net income, their decisions are not affected by their possibly short membership horizons. Thus they are more willing to support investments in intangible assets, such as brand name advertisement and R&D, necessary to compete successfully many of today's food and agriculture-related industries. In addition, members may put less pressure on their Boards and management, to accelerate equity redemption at the expense of retained earnings making possible a higher percentage of the earnings devoted to investment and other productive activities. Furthermore, amelioration of the horizon

constraint will be reflected in the debt financing practices with current members less likely to transfer some of the costs of providing capital and assuming individual risk, to future members thus insuring financially healthier and more attractive organizations to future generations.

The adoption of an effective equity redemption plan also impacts the correction of the horizon constraint. Although determining all the condition of an effective plan is too complex to accomplish here, it is clear that a short revolving period is required. Most cooperatives surveyed in this research do not have such a formal redemption program and the plans that do exist are characterized by a long revolving period. The impact of these equity revolvement programs on the ability of cooperatives to acquire risk capital remains an issue needing further exploration.

Members' ability to match their individual risk preferences to the investment portfolio of the cooperative firm is another important factor affecting investment incentives, the portfolio problem. Some of the US agricultural cooperatives have found transferability and appreciability of cooperative shares to be solutions to this problem. The use of separate capital pools in cooperatives engaged in more than one activity has also been tried by a few cooperatives but to date no definite conclusions can be drawn as to its effectiveness (Table 6.2)

Table 6.2. Solutions to the Investment Property Rights Constraints Implemented by Responding Cooperatives--1998

Constraint	Solution
Free Rider Constraint	• Closed Membership Policy • Marketing Agreement • Transferable and Appreciable Shares/Delivery Rights
Horizon Constraint	• Transferable and Appreciable Shares/Delivery Rights
Portfolio Constraint	• Transferable and Appreciable Shares/Delivery Rights

Implications for Cooperative Education

Educational programs for farmers and cooperative management should focus on how traditional cooperative principles affect cooperative organization and effectiveness. A promising area for the development of cooperative educational programs is research-driven executive education.

The property rights characteristics of traditional cooperative firms, the three (investment) vaguely defined property rights constraints and alternative solutions to resolving them, should attract the interest of cooperative educators. People involved in cooperative education, at any level, might consider reorganizing their teaching agendas to include the aforementioned important issues. It is no longer enough to educate producers

and their leaders about the cooperative principles and traditional cooperative practices. Several important links exist between such traditional issues and the problems facing today's cooperatives. Traditional cooperative principles reinforce the property rights environment responsible for creating the five vaguely defined property rights constraints. It might be important to consider the concept of cooperative values, which do not change over time, and distinguish that from cooperative practices (principles) which reflect the needs and characteristics of the historical era in which cooperatives exist.

Implications for Public Policy

The results of this research have material implications for the developments of public policy towards cooperatives and, more generally, farmers and rural areas. While not directly addressing issues concerning public support for agricultural cooperatives, the results can shed new light on some important aspects of this issue.

Agricultural cooperatives in US, during the last 110 years, have been the dominant form of collective action in agriculture. Through provisions of state and federal laws and regulations cooperatives have received public support in the form of specific tax advantages, limited immunity from antitrust constraints, access to favorable credit terms, state and federal security waivers, and technical assistance from public agencies. In return, agricultural cooperatives have implicitly and explicitly had to comply with numerous constraining rules, mainly in the form of the hard-core cooperative principles; the democratic control, service at cost, and limited return on equity principles.

These principles have created an organization type with a unique property rights structure. This structure in turn creates disincentives for non-members to join agricultural cooperatives and disincentives for farmer-members to invest significant amounts of risk capital in their cooperatives. Therefore, any public policy towards agricultural producers who want to act collectively should explicitly take into consideration the effect that these property rights characteristics of traditional cooperatives have on their organizational structure and efficiency.

Several studies have shown (e.g., Sexton and Iskow 1993, Fulton 1989) that agricultural cooperatives enhance competition, especially in oligopolistic industries. In addition, agricultural cooperatives are an excellent vehicle for rural development (Fulton and Ketilson 1992). However, in the future they may not be able to play these roles unless public policy allows for greater property rights clarification and flexibility by promoting laws, regulations, and practices that assist producer-owned and controlled organizations to ameliorate the five property rights constraints described in this study.

Those property rights characteristics found to ameliorate the three investment property rights constraints are (1) closed membership, (2) marketing agreements, and (3) transferable and appreciable shares/delivery rights. The optimal institutional environment that takes the importance of these characteristics into consideration, should have the following characteristics:

- Allow for the possibility of closed membership, in industries where the requirement for open membership may become a serious handicap for agricultural cooperatives to competing with other types of business firms free from similar constraints.

- Include regulations concerning the structure of marketing agreements between the cooperative and its members designed to achieve a delicate balance between the individual interests of farmer-members and their collective goals.
- Promote the establishment of secondary markets for cooperative residual claims that create the aforementioned conditions for overcoming the negative effect of investment property rights constraints on members' investment incentives.
- Develop educational programs that inform farmers and their cooperative leaders, about the adverse effects of the vaguely defined property rights constraints, and identify possible solutions to these problems.

Recommendations for Future Research

A study in the area of property rights and agricultural cooperatives, however comprehensive it may be, cannot discuss, analyze, and empirically test all aspects of these issues. In the case of this research, several aspects of the property rights structure of agricultural cooperatives were left for the future. The following delineates areas in need of further investigation, at both the theoretical and empirical levels:

1. a more thorough investigation of the portfolio constraint;
2. empirical investigation of the role of the exogenous institutional environment on the property rights structure of agricultural cooperatives;
3. an in depth analysis, both theoretical and empirical, of the collective decision-making constraints briefly introduced in the introductory chapter of this volume;

4. assessment of the relative importance of the control constraint (agency costs) for IOFs and agricultural cooperatives;
5. further development of the property rights theory of the cooperative firm.

The portfolio property rights constraint, which seriously affects members' investment incentives, can be ameliorated with transferable and appreciable shares. However, the portfolio problem is complex. While the role of separate capital pools in ameliorating this constraint was not statistically significant, additional work is needed because all important aspects of the portfolio constraint may not have been revealed. These results provide a first assessment of the importance of cooperative property rights characteristics in affecting incentives, and thus efficiency. The next step should be the investigation of these problems in more detail, perhaps by a series of case studies on different types of cooperatives, and for each of the constraints. This approach would provide insights complementary to those obtained in this study, and will enhance understanding of these issues. However, to ensure the case study approach as an optimal research tool, the design should be based on the property rights framework only. Theoretical and analytical rigor will insure the richness of the case studies results.

In conclusion, the case study approach might be used to investigate the other property rights constraints thus enabling researchers to acquire more detailed knowledge of the issues involved and encourage more accurate research in the future.

Another important issue, discussed briefly in this study, is the role of the exogenously determined institutional environment. Although the property rights approach generated several important insights, empirical work is needed to assess the

importance of these theoretical contributions. Both cooperatives and policy makers could utilize such results. The impact of regulations and laws on cooperative property rights and the design of optimal policies towards cooperatives are issues that cannot be overemphasized.

The assessment of the relative importance of the control constraint for cooperatives and IOFs is another area where a case study approach would provide rich insights for comparison. Such an approach could include studies of both IOFs and cooperatives of comparable size in the same industry, with an additional step of a formal quantitative and qualitative analyses of data tested empirically for previously hypothesized associations and causal relationships.

Finally, an area of intense interest during recent years is the study of collective action under the perspective of the property rights/incomplete contracts approach. Hart and Moore (1998) for example, proposed a model for studying the comparative advantages and disadvantages of cooperative and IOF ownership of an enterprise, and the conditions under which, each type of ownership arrangement is optimal. One of their results is that cooperatives work best, when membership heterogeneity is low. The results obtained in this study support this new approach for promising for further inquiry.

The insights provided in the incomplete contracting literature could be advantageously incorporated into the theoretical framework for studying cooperative property rights characteristics making possible empirical tests of new hypotheses in further research.

CHAPTER SEVEN

STUDY SUMMARY

This research addressed the issue of efficient user-owned and controlled organizational design. Using agricultural cooperatives as an example set of user-owned and controlled institutional arrangements the economic issue examined was the degree of residual rights of control and residual claims alignment. Leading organizational scholars (e.g., Milgrom and Roberts 1992, Hart 1995, and Hart and Moore 1998) suggest that, in the case of a firm, it is advantageous to have as many decision rights as possible vested with the party receiving the residual returns. This is because in the process of maximizing its own individual returns, that party will also generally be led to maximize organizational efficiency. Until now, scholarly work has concentrated on investor-oriented forms of business organization.

This study however, explores the applicability of the residual claims-residual control rights-argument to alternative business forms, specifically, inspection of the strength of the residual claims-residual control rights-criterion in examining user-owned firms. More specifically, this research applied the Coasian "nexus of contracts" definition of efficiency to user-owned agricultural cooperatives in US. Using a neo-institutional point of view, this study is concerned with the design of a producer-driven, collective action, business organization—an *ex ante* contract which assigns residual rights of control and residual claimant rights in an organizational efficiency-maximizing way.

In designing an efficiency-maximizing institutional arrangement for a producer-owned and controlled business firm, several important questions should be addressed: What are the origins of the current property right structure in US producer-owned business firms in agriculture? What are the efficiency implications of this structure? How could the inefficiencies characterizing this property right structure be ameliorated? What might be the characteristics of an efficiently designed producer-owned alternative ownership structure? Which ownership structure is successful in aligning residual rights of control and residual claims?

Development of a comprehensive theory of the cooperative firm began in the late 1940s. Until the early 1980s, most models of the cooperative firm were based on concepts and ideas from neoclassical economics, a framework useful for understanding the operation of markets, and the role of cooperative firms in these markets. However, neoclassical theory completely ignores problems within the firm, and thus, it has little to say about the internal organization of firms and fails to address the aforementioned questions.

During the 1980s and 1990s, the emergence of neo-institutional economics and its sub-fields of transaction cost economics, agency theory, and property rights offered an alternative theoretical economic framework enabling analysis of several important issues such as the delegation of decisions, authority distribution, asset ownership, and economic incentives facing cooperative stakeholders.

The branch of neo-institutional economics that focuses on economic incentives within the firm is the property rights approach. Research within this paradigm provides

social scientists with unique insights into the organization of complex organizations and empirical research appears to confirm the main propositions generated.

The study of the cooperative firm that incorporates the role of property rights in its assumptions, is helpful in understanding the organization and their internal strengths and weaknesses. The role and motivation of cooperative stakeholders (members, board of directors, and management) can only be studied with respect to the incentives facing them. Nonetheless, these incentives change dramatically when property right structure changes. Furthermore, a number of scholars have argued that the assignment of economic property rights has a significant impact on cooperative structure and performance as well as important public policy implications. In the past, these theoretical arguments have not been accompanied by empirical tests to further the understanding of property rights which affect members' incentives for contributing to the long term financial stability and health of their organizations. This research, attempts to test empirically several research hypotheses related to the effect of property rights on the investment incentives of cooperative members.

In traditional cooperatives, the most important characteristics of property rights, which distinguish them from investor-oriented firms (IOFs) are: (1) restrictions on the ownership of cooperative residual claims, resulting in misalignment of residual control and residual claimant rights; (2) restrictions on the transferability of residual claims; (3) restrictions on the redeemability of residual claims; and (4) a limited horizon of residual claims. Cooperative principles, state and federal laws, regulations, and firm specific bylaws all seem to reinforce the impact of these characteristics and lead to a set of five

problems, which form the bases of the five vaguely defined property right constraints. These can be further classified into investment and collective decision making constraints. This study however focuses exclusively on the three investment property right constraints.

Investment constraints, the free rider, horizon and portfolio constraints, were hypothesized to directly affect members' incentives to invest in their organizations. The free rider problem has two distinct types. The external free rider constraint arises when property rights are untradeable, insecure, or unassigned and therefore do not ensure that current member-patrons or current non-member-patrons bear the full costs of their actions and/or receive the full benefits they create. An example would be a non- member producer who receives benefits in the form of higher prices achieved from lobbying efforts by a local bargaining association without bearing any of the associated costs.

The second type, the internal free rider problem occurs when new members obtain the same patronage and residual rights as existing members and are entitled to the same payment per unit of patronage. This results in a dilution of the rate of return to existing members, thereby creating a disincentive to invest in their cooperative.

The horizon constraint refers to the creation of a business environment in which there is a disincentive for members to contribute to growth opportunities. This situation is created whenever a member's residual claim on the net income generated by an asset is shorter than the productive life of that asset. Again, it is restrictions on transferability of residual claimant rights and the lack of liquidity through a secondary market for the transfer of such rights that gives rise to the horizon problem. The problem becomes more

serious when considering investments in intangible assets and results in pressure on the Board of Directors and management to increase the proportion of the cooperative's cash flow devoted to current payments to members, relative to investment, and accelerated equity redemption at the expense of retained earnings.

The portfolio constraint occurs when cooperative members, with a lack of transferability, liquidity, and appreciation mechanisms for exchange of residual claims, are not able to adjust their cooperative asset portfolio to match their personal risk preferences. Since the investment decision in cooperatives is "tied" to the patronage decision, members come to hold portfolios with more or less risk than they prefer. There is a tendency for them to pressure cooperative decision-makers to rearrange the cooperative's investment portfolio even if that means lower expected returns.

The main hypothesis of this research is that the property right structure observed in cooperative firms significantly affects the incentives of members to invest in their organizations. This hypothesis, along with several other research hypotheses was tested by means of a structural equation model. Descriptive and inferential statistics are also used for testing hypotheses associated with variables not incorporated in the structural model.

The data used for testing hypotheses were collected, in the period from March 1998 to June 1998, through a national mail survey of US agricultural cooperatives. The cooperatives included in the sample were: regional marketing cooperatives (Sapiro II); regional supply and/or marketing cooperatives (Nourse II); new generation cooperatives (Sapiro III); and local multi-purpose cooperatives (Nourse I). The criterion employed in

sample selection was that cooperatives in the sample represent over seventy five percent of US agricultural cooperatives, in terms of sales. It was assumed that, within these cooperatives, problems in convincing members to contribute risk capital would be more intense. Data from new generation cooperatives adopting a non-traditional property right structure were included, so that a comparison of different property right structures would be possible.

The obtained results suggest that the property right structure of US agricultural cooperatives significantly affect members' incentive to invest in their organizations. The "adopted membership policy" has the most significant influence on members' investment incentives. Fifty-five percent of the variation in members' investment incentives can be attributed to changes in the adopted membership policy. The results suggest that in closed membership cooperatives, members invest significantly more than in open membership ones. Similarly, thirty-nine percent of the variation in members' investment incentives is attributable to variation in members' commitment to the cooperative through an enforceable marketing agreement. Closed membership and marketing agreements are both mechanisms used to achieve a high degree of members' commitment to the cooperative. The difference between the estimates of these two property right characteristics may arise because of their different natures. That is, closed membership policy does not require the commitment of members' resources to the cooperative goal, at least to the extent that a marketing agreement does, and therefore members may prefer it. The two property rights characteristics, closed membership and marketing agreement,

align residual control and residual claimant rights and thus ameliorate the internal and some of the external free rider constraints.

Transferability and appreciability of cooperative shares also affect members' investment by introducing a secondary market, resembling the stock market for IOFs' residual claims. Members can capture the value of their investments in the cooperative, irrespective of the length of their membership horizons, ameliorating the horizon constraint significantly.

In addition, the creation of a secondary market for cooperative residual claims allows members to match their risk preferences to the risk associated with the cooperative investment portfolio. In this way, members decisions to support an investment, is solely based on its potential profitability, and not on their attitudes toward risk. Consequently, the portfolio constraint is also, ameliorated.

These results have significant implications for US agricultural cooperatives, and for those designing public policies affecting these unique business organizations. Cooperative members and their leaders should understand the significant role of clearly defined property rights in attracting new members, a condition necessary for the future development of their organizations. When the benefits of cooperation are not diluted among members and non-members, and when cooperative investments are attractive to outsiders, incentives for membership and investment are enhanced.

Also, clearly defined property rights affect not only the incentives of potential members but also of current members. Policies such as closed membership and marketing agreements ensure current members that any net benefits resulting from their investments will be shared only among them on a proportional basis. Thus, existing members do not hesitate to invest in their cooperatives, since they can capture the value of their investments.

The creation of a secondary market for cooperative shares and/or delivery rights, is another investment incentive-stimulating mechanism. When members can capture the market value of their investment decisions, by selling their residual claims to the cooperative's future net income, their decisions are independent of their possibly short membership horizons. Members are thus encouraged to support investments in intangible assets, such as brand name advertisement and R&D, necessary for successfully competing in many of today's food and agriculture-related industries.

Transferable and appreciable shares allow members to capture the full value of their investments and thus put less pressure on their Boards and management to accelerate equity redemption at the expense of retained earnings, leading to a higher percentage of the earnings devoted to investment and other productive activities. Furthermore, the debt financing practices in these cooperatives will ameliorate the horizon constraint by discouraging current members from choosing to transfer some of the costs of capital and risk assumption to future members. Such approaches lead to financially healthier organizations and makes cooperative firms more attractive to future generations.

The ability of members to match their individual risk preferences to the investment portfolio of the cooperative firm is also an important factor affecting members' investment incentives. Transferability and appreciability of cooperative shares is found to be the most important practice implemented by some US agricultural cooperatives.

In addition, the results of this research have material implications for those involved in designing public policy towards agricultural cooperatives, farmers, and rural areas. Several studies have shown that agricultural cooperatives enhance competition, especially in oligopolistic industries, and also are excellent tools for rural development. Therefore, public policy affecting agricultural cooperatives should promote an institutional environment that recognizes the uniqueness of these organizations' property rights structures, and promotes laws, regulations, and practices that help cooperatives ameliorate the five property rights constraints. Such an institutional environment should have the following characteristics:

- Allow for the possibility of closed membership cooperatives, in increasingly capital-intensive industries where open membership may become a serious competitive handicap.
- Develop regulations for the structure of marketing agreements between the cooperative and its members designed to achieve a delicate balance between the individual interests of farmer-members and their collective goals.

Additionally, the educational efforts of government organizations, about cooperative development, should include programs that educate farmers and their

cooperative leaders, on the adverse effects of the vaguely defined property right constraints, and identify possible solutions to these problems.

A study in the area of property rights and agricultural cooperatives, however comprehensive, cannot discuss, analyze, and empirically test all aspects of these issues. Some of the research topics/problems to be addressed by future research are:

1. additional investigation of the portfolio constraint;
2. empirical investigation of the role of the exogenous institutional environment on the property right structures;
3. theoretical and empirical analysis of the collective decision-making constraints;
4. assessment of the relative importance of the control constraint (agency costs) for IOFs and agricultural cooperatives;
5. further development of the property rights theory of the cooperative firm.

As hypothesized within the neo-institutional theoretical framework the property rights structure found in traditional US agricultural cooperatives results in misalignment of residual claims and residual rights of control, which leads to an inefficient institutional arrangement. This arrangement fails to provide producer-members with incentives to invest in their organizations. On the other hand, cooperatives that are moving toward a non-traditional property rights structure exhibit a higher investment. Consequently, a statement can be made for agricultural cooperatives: altering their organizational structure toward a more efficient property rights arrangement is a prerequisite for attracting members' investment.

APPENDIX ONE

INTRODUCTORY LETTERS FOR SURVEY OF US AGRICULTURAL COOPERATIVES

In this appendix, the letters accompanying the survey of US agricultural cooperatives are presented.

Letter for Nourse I -- Local Cooperatives

January ..., 1998

Dear Mr. .....

I need your help.

The objective of this letter is to request your assistance in analyzing one of the most pressing issues faced by U.S. cooperative leaders today – how to align cooperative organizational design with equity capital acquisition. We are assuming that as your local cooperative enters an even more capital intensive stage of its development, the demand for risk capital in your organization will continue to grow.

Enclosed are two surveys. One is for you, the CEO (General manager), the other is to be completed by yourself or a top manager (ex. Finance person) possessing knowledge of your equity capital acquisition and redemption plans. If you personally do not complete the top management survey, we would appreciate it if you assigned somebody in your organization to do so. It is very important to have both surveys completed by each select cooperative. The surveys are quite different and the results are sensitive to variation in who completes the surveys.

This research is the first stage of a three-part study in which cooperative options for organizational structure and capital acquisition will be examined in detail. If we acquire sufficient data the results, even from these first two surveys, should be useful for cooperative leaders as input into some of your structural and financial decision making.

Working with me in the first stage of this project is a team of research associates and graduate students led by Costas Iliopoulos. Costas is writing his Ph.D. dissertation on the organizational design of incentives and disincentives in risk capital investment in U.S. cooperatives.
All of your answers to this survey will be treated with complete confidentiality. Disclosure of information acquired in this study will be revealed only in aggregated form.

As you complete the surveys, please find enclosed self-addressed envelopes. We would be most grateful if you returned them as soon as possible . Also, please enclose a copy of your 1997 annual report – this is extremely important. When the analysis of the first stage of our surveys is completed, we will immediately mail you a copy of the preliminary findings.

Allow me to thank you beforehand for your participation and contribution – it is most appreciated.

Best Regards,

Michael L. Cook
Robert D. Partridge Chair

Letter for Nourse II and Sapiro II Cooperatives

January ..., 1998

Dear Mr. .....

I need your help.

The objective of this letter is to request your assistance in analyzing one of the most pressing issues faced by U.S. cooperative leaders today – how to align cooperative organizational design with equity capital acquisition. We are assuming that as you enter an even more capital-intensive stage of your development, the demand for risk capital in your organization will continue to grow.

Enclosed are two surveys. One is for you, the CEO, the other is to be completed by yourself or a top manager (ex. CFO or VP of Member relations) possessing knowledge of your equity capital acquisition and redemption plans. If you personally do not complete the top management survey, we would appreciate it if you assigned somebody in your organization to do so. It is very important to have both surveys completed by each select cooperative. The surveys are quite different and the results are sensitive to variation in who completes the surveys.

This research is the first stage of a three-part study in which cooperative options for organizational structure and capital acquisition will be examined in detail. If we acquire sufficient data the results, even from these first two surveys, should be useful for cooperative leaders as input into some of your structural and financial decision making.

Working with me in the first stage of this project is a team of research associates and graduate students led by Costas Iliopoulos. Costas is writing his Ph.D. dissertation on the organizational design of incentives and disincentives in risk capital investment in U.S. cooperatives.

All of your answers to this survey will be treated with complete confidentiality. Disclosure of information acquired in this study will be revealed only in an aggregated form.

As you complete the surveys, please find enclosed self-addressed envelopes. We would be most grateful if you returned them as soon as possible. When the analysis of the first stage of our surveys is completed, we will immediately mail you a copy of the findings.

Allow me to thank you beforehand for your participation and contribution -- it is most appreciated.

Best regards,

Michael L. Cook
Robert D. Partridge Chair

Letter for Sapiro III-New Generation Cooperatives

January ..., 1998

Dear Mr. .....

We need your help again. Two years ago we asked you to help us understand the challenges of starting a New Generation Cooperative. Your input was invaluable. Under separate cover, we are sending you two papers discussing these challenges:

1) Definitional and Classification Issues in Analyzing Cooperative Organizational Forms, and,
2) The Transition to New Cooperative Organizational Forms: Public Policy Issues.

By early spring, the guidebook on establishing New Generation Cooperatives will be editorially approved and we will send you a copy, as promised.

The objective of this letter is to request your assistance in analyzing one of the most pressing issues faced by U.S. cooperative leaders today – how to align cooperative organizational design with equity capital acquisition. New generation cooperatives were designed to achieve this alignment. However, we are assuming that as you enter an even more capital-intensive stage of your development, the demand for risk capital in your organization will continue to grow.

Enclosed are two surveys. One is for you, the CEO, the other is to be completed by yourself or a top manager (ex. CFO or VP of Member relations) possessing knowledge of your equity capital acquisition and redemption plans. If you personally do not complete the top management survey, we would appreciate it if you assigned somebody in your organization to do so. It is very important to have both surveys completed by each select cooperative. The surveys are quite different and the results are sensitive to variation in who completes the surveys.

This research is the first stage of a three-part study in which cooperative options for organizational structure and capital acquisition will be examined in detail. If we acquire sufficient data the results, even these first two surveys, should be useful for cooperative leaders as input into some of your structural and financial decision making.

All of your answers to this survey will be treated with complete confidentiality. Disclosure of information acquired in this study will be revealed only in aggregated form.

As you complete the surveys, please find enclosed self-addressed envelopes. We would be most grateful if you returned them as soon as possible . Also, please enclose a copy of your 1997 annual report – this is extremely important. When the analysis of the first stage of our surveys is completed, we will immediately mail you a copy of the findings.

Allow me to thank you beforehand for your participation and contribution – it is most appreciated.

Best Regards,

Michael L. Cook
Robert D. Partridge Chair

Thank You Letter to Cooperatives that Responded

May 8, 1998

Dear Mr. ……..

Thank you for taking the time to complete our surveys on Cooperative organizational design and equity capital acquisition – your contribution is most appreciated. As soon as our analysis is completed, we will immediately mail you a copy of the findings.

As the last step towards the completion of this research, I would like to request a copy of your most recent annual report. We would be most grateful if you mailed us the annual report as soon as possible. This is CRITICAL for the completion of this project. Let me remind you that all information will be treated with complete confidentiality. Disclosure of information acquired in this study will be revealed only in an aggregated form.

Allow me to thank you for your participation and contribution – it is most appreciated.

Best Regards,

Costas Iliopoulos
Research Associate

Michael L. Cook
Robert D. Partridge Chair

APPENDIX TWO

SURVEY QUESTIONNAIRES

CEO Questionnaire

Date: _____

Name: _____

Name of Cooperative: _____

Position held: _____

1. **How much of your working time do you regularly spend on MEMBER RELATIONS? Please check.**

10% or Less	10% - 20%	21% - 30%	31% - 40%	41% - 50%	50% or More

2. **Relative to non-cooperative competitors, does your cooperative make investment decisions that are:**

Less Risky	The Same	More Risky

3. **Do board members generally agree when you propose making an investment unrelated to the cooperative's current activities? Please check.**

   YES
   NO
   OTHER, PLEASE DESCRIBE

4. **When distributing the cooperative's net earnings, which members prefer to have most of the current earnings distributed in cash? Please Check.**

Existing members	_____
Members about to exit	_____
Inactive members	_____
New members	_____
Other: _____	_____

5. **During the last five years, do you recall any significant pressure from the members/board to liquidate some or all of the cooperative's assets?**

   _____ **YES** _____**NO**

6. **Does your board play any role in making decisions about new membership? Please check.**

No Involvement	Approval is "Just a Formality"	Board Votes After General Discussion	Board Votes After Detailed Formal Process

7. **What is your current board size? _____**

8. **Would the current board prefer a larger or smaller board?**

_____LARGER _____SMALLER

9. What size? _____

In your opinion, what is the optimal size of the board of directors in a cooperative similar to yours? Please check.

7 Members or Fewer	7 - 10 Members	11 - 15 Members	15 Members or More

11. The following choices are important in cooperative decision making. How might your board view these choices. Please evaluate each of the following choices.

	Low Priority	Moderately Low Priority	Moderately High Priority	High Priority
Percentage of Patronage Refunds Paid in Cash				
Allocation of Costs to Different Pools				
Investment in New Activities				
Amount Invested in R&D				
Amount Invested in Educational Activities				

12. Of the members who stopped patronizing the cooperative in the last five years, which of the following categories related to business dollar value best describes them?

Below average	Slightly below average	Slightly above average	Above average	Other, please explain

13. How often do you observe serious disagreements between members about cooperative matters (e.g., a new investment, the location of a new plant, the level of patronage refunds)

Never	Some Times	Often	Very Often

14. Mutual trust between members is very important. In your opinion, what is the degree of trust between members in your cooperative? Please check.

Very Low	Moderately Low	Moderately High	Very High

15. Please read the list of eight cooperative objectives and check the three that most closely represent your cooperative's objectives.

Provide the best possible services to members

Minimize conflict among members

Keeping financial ratios within pre-specified limits

Paying the highest market price when marketing members' products

The lowest possible price for farm inputs

The highest possible patronage refund in cash

The highest return on assets

The highest amount revolved each year

Other

16. How often are board members involved in pricing and cost allocation decisions? Please check.

Never **Some Times** **Often** **Very Often**

If you answered "Never", please go to Question 18

17. Is it difficult for board members to reach consensus on pricing and cost allocation rules? Please check.

Easy **Not too Difficult** **Difficult** **Very Difficult**

18. How often do you observe temporary or permanent voting blocs among board members? Please check.

Almost Never	Seldom	Often	Very Often

19. Do you know of any cooperative CEO whose salary has not increased in the last five years?

____YES ____NO

20. How would you compare CEO compensation in your cooperative relative to other similar business firms? Please check.

Much Lower	Slightly Lower	Slightly Higher	Much Higher

21. In your opinion, what is the optimal size of <u>membership</u> in a cooperative similar to yours? Please check.

Much Smaller than in our Cooperative	Slightly Smaller than in our Cooperative	Slightly Larger than in our Cooperative	Much Larger than in our Cooperative

22. At the present time how would you rate your cooperative's performance? Please check.

Far Worse than Expected	Slightly Worse than Expected	Slightly Better than Expected	Far Better than Expected

23. Do you think that cooperative principles, as guidelines for decision making, are as important today as they were in the past?

_____ **YES** _____ **NO**

Please explain **:**_____

_____

_____

_____

Top Management Questionnaire for Nourse Cooperatives

Date: _____

Name: _____

Name of Cooperative: _____

Position held: _____

1. **In general, the membership you serve is considered to be; Please check one of the following.**

Local **State** **Regional** **National** **International**

2. **Please check whether your members are <u>mainly</u>:**

Farmers _____

Local cooperatives _____**Go to Question 5**

Both farmers and local cooperatives _____**Go to Question 7**

3. **In general, does your cooperative accept all producers who apply for membership?** open/closed

_____ **YES** _____ **NO**

4. **In how many <u>counties</u>, within your state, does your cooperative have members?**

_____

5. **Are potential or current members required to own a farm?** __

_____ **YES** _____ **NO**

6. **Approximately, what percentage of the cooperative members' farms are legally incorporated? Please check.**

1% - 5% 6% - 10% 11% - 20% 21% - 30% 31% - 50% 50% or More

7. **In how many US states does your cooperative have members? _____**

8. **In how many foreign countries, does your cooperative have members?_____**

9. **To become a member is a membership fee required?**

_____ YES, AMOUNT $_____

_____ NO

10. **Does this membership fee give a member the right to vote?**

_____ YES _____ NO

11. **In order to become a member, is it required to purchase stock or make any other up-front equity capital contribution?**

_____ YES

_____ NO Go to question 15

12. **What is this amount? _____**

13. **Is there a minimum? _____YES _____NO**

14. **Is there a maximum? _____YES _____NO**

15. **Do you recall any attempts by your cooperative to expand its membership in the last 5 years?**

external PR

____ YES ____ NO

16. When does a member lose their right to vote? Please check.

After being inactive for one year _____

After being inactive for two years _____

After all his/her patronage refunds have been redeemed _____

Other _____
Please explain _____

17. Do your bylaws specify on what issues membership votes on?

_____ YES _____ NO

18. On how many cooperative business issues does your members vote each year?
_____

19. Approximately, how many different major farm inputs does your cooperative supply to its members? _____

20. Approximately how many major products does your cooperative market for its members? _____

21. Does your cooperative have any brand name products?

_____ YES

_____ NO Go to Question 25

22. What percentage of your products is marketed under brand names?

1% - 5%	6% - 10%	11% - 15%	16% - 20%	21% - 30%	30% or More

23. Does your cooperative use brand name advertising?

_____ YES _____ NO. Go to Question 25

24. **Approximately what percentage of your gross revenues is devoted to brand name advertising? Please check.**

2% or Less	2% - 4%	4% - 6%	6% - 8%	8% - 10%	10% or More

25. **Do you compete with other cooperatives for members?**

_____YES _____ NO

26. Do you compete with other <u>cooperatives</u> in product marketing?

_____ YES _____ NO

27. **Do you compete with <u>non-cooperative</u> firms in product marketing?**

_____YES _____NO

28. **How often do members meet with <u>each other</u> in social gatherings/events?**

Almost Never	Sometimes	Frequently	Very Frequently

29. **How often do members meet with members <u>of your management team</u> in social gatherings/events?**

Almost Never	Some Times	Frequently	Very Frequently

30. **Which voting system does your cooperative use? Please check.**

<u>One-member, one-vote</u> _____

<u>Weighted:</u>

1. Depending on dollar amount of business with the cooperative _____

2. Depending on volume of business with the cooperative _____

3. Combination of 1 and 2. _____

31. Approximately, what percentage of your members exited the cooperative last year for reasons other than retirement or sale of their farm?

1% - 5%	6% - 10%	11% - 20%	21% - 30%	31% - 40%	40% or More

32. Does your cooperative have a formal plan to redeem equity capital?

_____ YES

_____ NO. Go to Question 39

33. Please check the plans that most apply to your cooperative:

Traditional Revolving fund plan	_____ YES
Base capital plan	_____ YES. Go to Question 38
Percentage-of-all equities plan	_____ YES
Special situation plan (death, retirement, etc.)	_____ YES

34. Please check the length of the revolving period that applies to your cooperative:

1 - 7 Years	8 - 13 Years	14 - 20 Years	20 Years or More

35. In the past, the length of the revolving period has been: (Please check)

_____Shorter than currently

_____Longer than currently

36. Do you use the same revolving plan for all your members?

_____YES _____NO

37. Do you use separate revolving funds for each of the main products handled (or farm inputs provided) by your cooperative?

_____YES _____NO

38. **How long is the revolving period for the <u>base capital plan</u>? Please check.**

1 - 5 Years	6 - 10 Years	11 - 15 Years	Other

39. **Approximately, what percentage of your current members have contributed less equity capital in the cooperative than their proportion of business? Please check.**

1% - 10%	11% - 15%	16% - 20%	21% - 30%	31% - 40%	40% or More

40. **Approximately, what percentage of your current members have contributed more equity capital in the cooperative than their proportion of business? Please check.**

1% - 10%	11% - 15%	16% - 20%	21% - 30%	31% - 40%	40% or More

41. **Does your cooperative invest in Research and Development (R&D)?**

____ YES _____ NO Go to Question 43

42. **Approximately what percentage of your gross revenues is devoted to R&D? Please check.**

2% or Less	2% - 4%	4% - 6%	6% - 8%	8% - 10%	10% or More

43. If members buy more than one input from the cooperative, is their equity capital accounted for in separate capital pools?

_____ YES _____ NO

44. When members use more than one of the cooperative's business lines, is their equity capital accounted for in separate capital pools?

_____YES _____NO

45. Does the cooperative pay interest on members' allocated equity capital?

_____ YES _____ NO. Go to Question 47

46. What is the interest rate ?

Less than 8% ____
More than 8% ____

47. How are the overhead costs divided among the cooperative's members? Please check.

Proportional to business with the cooperative
Divided equally among members
Other (Please Describe)

48. Unallocated equity, or permanent capital, makes up what percentage of the equity portion of your balancesheet? _____

49. Is there specific policy to increase or decrease? Please check.

Increase
Decrease

Does your cooperative issue long-term bonds?

_____ YES _____ NO. Go to Question 52

51. Do the long-term bonds include any sinking-fund provision?

_____ YES _____ NO

52. Approximately, what percentage of the cooperative members' farms are legally incorporated? Please check.

1%- 5%	6% - 10%	11% - 20%	21% - 30%	31% - 50%	50% or More

53. Listed below are commonly used methods for cooperatives in acquiring equity capital. Please indicate which methods were utilized by your cooperative in the past fiscal year.

CAPITAL GENERATED FROM MEMBERS

Retained patronage refunds _____
Equity put in permanent equity (paid taxes) _____
Per-Unit Retains from members _____
Preferred stock _____
Direct request _____

B. **CAPITAL GENERATED FROM NON-MEMBERS**

Net savings from non-member business _____
Preferred stock _____
Other. Please explain _____

C. **DIRECT INVESTMENT** (Usually not a significant source)

Membership fee from new members _____
Investment from new members other than membership fee _____
Direct investment from existing members _____

54. Does your cooperative provide <u>hedging</u> for its members?

_____ **YES** _____ **NO**

Top Management Questionnaire for Sapiro Cooperatives

Date: _____

Name: _____

Name of Cooperative: _____

Position held: _____

1. **In general, the membership you serve is considered to be; Please check one of the following.**

   Local **State** **Regional** **National** **International**

2. **In how many U.S. states does your cooperative have members?** _____

3. **In how many countries does your cooperative have members?** _____

4. **In general, does your cooperative accept all producers who apply for membership?**

   open/closed

   _____ **YES** _____ **NO**

5. **Is it required, in order to become a member, to own a farm?**

   _____ **YES** _____ **NO**

6. **To become a member, is a membership fee required?**

   _____ **YES, AMOUNT $**_____

   _____ **NO**

7. **Does this membership fee give a member the right to vote?**

_____ **YES** _____ **NO**

8. **Do members purchase the right to deliver their produce to the cooperative?**

   _____ **YES** _____ **NO. Go to Question 10**

9. **How is the price of this delivery right determined for each member? Please check.**

   (i) **According to acres of land cultivated** _____
   (ii) **According to volume of production** _____
   (iii) **Other** _____
   Please explain _____

10. **In order to become a member, is it required to purchase stock or make any other up-front capital contribution?**

   _____ **YES** _____ **NO. Go to Question 14**

11. **What is this amount?** _____

12. **Is there a minimum?** _____**YES** _____**NO**

13. **Is there a maximum?** _____**YES** _____**NO**

14. **Is it required for a member to sign a marketing agreement with the cooperative?**
   _____ **YES** _____ **NO.**

15. **What are the penalties if a member does not fulfill the marketing agreement obligations? Please check all that apply.**

   Loss of patronage and value-added payments _____

   Forfeiture of equity shares _____

   Member must purchase product from spot market _____

   Member must purchase product from pool _____

   The cooperative purchases from spot market or other source in member's name _____

   Other _____

16. **Can a member transfer their ownership rights in the cooperative to <u>another member</u>?**

_____ **YES** _____ **NO**

17. Can a member transfer their ownership rights in the cooperative to a non-member?

_____ YES _____ NO

18. Can a member transfer their ownership rights in the cooperative to a family member?

_____ YES _____ NO

19. Do you recall any attempts by your cooperative to expand its membership in the last 5 years?

____ YES ____ NO

20. When does a member lose their right to vote? Please check.

After being inactive for one year _____

After being inactive for two years _____

After all their patronage refunds have been redeemed _____

Other _____

Please explain _____

21. Do your bylaws specify on what issues membership votes on?

_____ YES _____ NO

22. On how many cooperative business issues does your members vote each years?

_____

23. Approximately, how many major products does your cooperative market for its members? _____

24. Does your cooperative have any brand name products?

_____ YES

_____ NO Go to Question 28

25. What percentage of your products are marketed under brand names? Please check.

1% - 5%	6% - 10%	11% - 15%	16% - 20%	21% - 30%	30% or More

26. Does your cooperative use brand name advertising?

_____ YES _____ NO. Go to Question 28

27. Approximately what percentage of your operating budget is devoted to brand name advertising? Please check.

2% or Less	2% - 4%	4% - 6%	6% - 8%	8% - 10%	10% or More

28. Do you compete with other cooperatives for members?

____YES _____ NO

29. Do you compete with other cooperatives in product marketing?

_____ YES _____ NO

30. Do you compete with non-cooperative firms in product marketing?

_____ YES _____ NO

31. Does your cooperative use a third party for grading/classifying products delivered the members?

_____ YES _____ NO

32. How often do members meet with each other in social gatherings/events?

Almost Never	Sometimes	Frequently	Very Frequently

33. How often do members meet with members <u>of your management team</u> in social gatherings/events?

Almost Never **Some Times** **Frequently** **Very Frequently**

34. Which voting system does your cooperative use? Please check.

<u>One-member, one-vote</u> _____

<u>Weighted:</u>

1. Depending on dollar amount of business with the cooperative _____

2. Depending on volume of business with the cooperative _____

3. Combination of 1 and 2. _____

35. Approximately, what percentage of your members exited the cooperative last year for reasons other than retirement or sale of their farm?

1% - 5% **6% - 10%** **11% - 20%** **21% - 30%** **31% - 40%** **40% or More**

36. Does your cooperative have a formal plan to redeem equity?

_____ **YES**

_____ **NO. Go to Question 43**

37. Please check the plans that most apply to your cooperative:

Traditional Revolving fund plan _____ **YES**

Base capital plan _____ **YES. Go to Question 42**

Percentage-of-all equities plan _____ **YES**

Special situation plan _____ **YES**

(death, retirement, etc.)

38. Please check the length of the revolving period that applies to your cooperative:

1 - 7 Years	8 - 13 Years	14 - 20 Years	20 Years or More

39. In the past, the length of the revolving period has been: (Please check)

_____Shorter than currently

_____Longer than currently

40. Do you use the same revolving plan for all your members?

_____YES _____NO

41. Do you use separate revolving funds for each of the main products handled by your cooperative?

_____YES _____NO

42. How long is the revolving period for the <u>base capital plan</u>? Please check.

1 - 5 Years	6 - 10 Years	11 - 15 Years	Other

43. Is your stock tradable?

_____ YES _____ NO. Go to Question 45

44. Can cooperative stock/shares appreciate/depreciate in value when traded?

_____ YES _____ NO

45. What percentage of your current members has contributed less equity capital in the cooperative than their proportion of business? Please check.

1% - 10%	11% - 15%	16% - 20%	21% - 30%	31% - 40%	40% or More

46. Does your cooperative provide hedging for its members?

_____ YES _____ NO

47. What percentage of your current members has contributed more equity capital in the cooperative than their proportion of business? Please check.

1% - 10%	11% - 15%	16% - 20%	21% - 30%	31% - 40%	40% or More

48. Does your cooperative invest in Research and Development (R&D)?

____ YES _____ NO. Go to Question 50

49. Approximately what percentage of your gross revenue is devoted to R&D?

2% or Less	2% - 4%	4% - 6%	6% - 8%	8% - 10%	10% or More

50. If members market more than one product through the cooperative, is their equity capital accounted for in separate capital pools?

_____YES ____NO

51. How are the overhead costs divided among the cooperative's members? Please check.

Proportional to business with the cooperative
Divided equally among members
Other (Please Describe)

52. Does the cooperative pay interest on members' allocated equity capital?

_____ YES _____ NO. Go to Question 54

53. What is the interest rate?

Less than 8% ____

More than 8% ____

54. Unallocated equity, or permanent capital, makes up what percentage of the equity portion of your balancesheet? _____

55. Is there a specific policy to increase or decrease? Please check.

Increase

Decrease

56. Does your cooperative issue long-term bonds?

_____ YES _____ NO. Go to Question 58

57. Do the long-term bonds include any sinking-fund provision?

_____ YES _____ NO

58. Approximately, what percentage of the cooperative members' farms are legally incorporated? Please check.

1%- 5%	6% - 10%	11% - 20%	21% - 30%	31% - 50%	50% or More

59. Listed below are commonly used methods for cooperatives in acquiring equity capital. Please indicate which methods were utilized by your cooperative in the past fiscal year.

CAPITAL GENERATED FROM MEMBERS

Retained patronage refunds	_____
Equity put in permanent equity (paid taxes)	_____
Per-Unit Retains from members	_____
Preferred stock	_____
Direct request	_____

B. CAPITAL GENERATED FROM NON-MEMBERS

Net savings from non-member business	_____
Preferred stock	_____
Other. Please explain _____	

C. **DIRECT INVESTMENT** (Usually not a significant source)

Membership fee from new members _____

Investment from new members other than membership fee _____

Direct investment from existing members _____

APPENDIX THREE

STRUCTURAL EQUATIONS WITH LATENT VARIABLES

Step 1: Developing a Theoretically Based Model

In the first step of structural equation modeling, causal relationships between the variables must be established. The strength and conviction with which causation between two variables can be assumed lies not in the analytical methods chosen, but in the theoretical justification provided to support the analysis.

The concept of causality has many connotations. Bollen (1989) proposed three conditions that must be met in order to establish a causal relation; isolation, association, and direction of causality. Isolation refers to whether a dependent variable can be isolated from all influences but a single explanatory variable. Since such isolation is not always feasible, this condition can be replaced with pseudo-isolation by assuming that the disturbance is not correlated with the exogenous variable from an equation (Bollen 1989).

The second condition, association, requires that a causal variable should be associated with an effect after the two are pseudo-isolated. Sampling fluctuations are one threat to assessing such associations even when an equation is correct. Other problems are created when the standard errors and test statistics are biased due to uncorrected problems of heteroscedastic or autocorrelated disturbances or measurement errors. Replication of an association in an independent sample is one means to increase confidence that an association is robust.

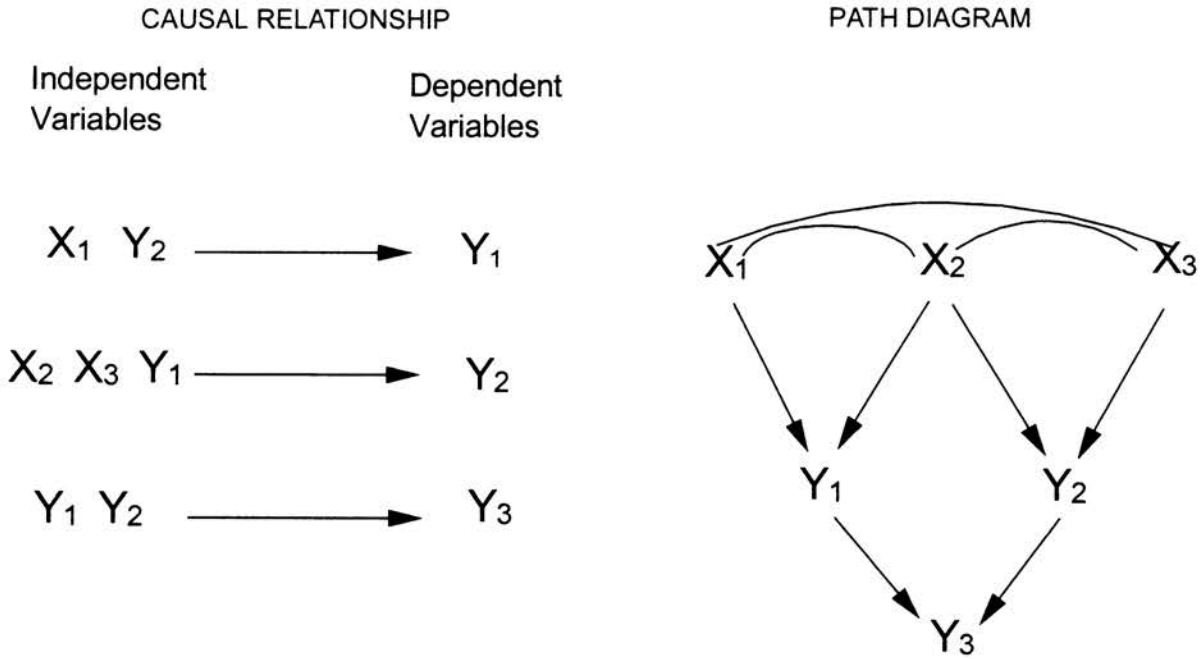
Finally, establishing the direction of influence between two variables is necessary to establishing a causal relation. Knowing that one variable precedes another in time is probably the single most effective criterion of establishing direction of causality.

Although in many instances not all of the above conditions are strictly met, strong assertions can possibly be made if the relationships are based on a theoretical rationale. In developing a robust theoretical model, specification errors should be avoided to minimize estimation biases. Up to a limit, all variables that are theoretically justified should enter the model specification.

Step 2: Constructing a Path Diagram of Causal Relationships

Path diagrams are helpful in depicting a series of causal relationships. Figure A-Three.1, below, shows the transformation of causal relationships to path diagrams.

Figure A-Four.1. Representing Causal Relationships Through Path Diagrams



One basic assumption underlying path diagrams is that all causal relationships are indicated on the diagram. In satisfying this assumption, theory must be the basis for the inclusion or omission of any relationship. Another important assumption relates to the nature of the causal relationships, which are assumed to be linear. However, modified structural models can approximate nonlinear relationships (Haydeck 1987; Loehlin 1987).

It should also be noted that all constructs in a path diagram can be divided into two categories: (1) exogenous constructs, or independent variables, that are not "caused" or predicted by any other variables in the model, and (2) endogenous constructs which are predicted by one or more other constructs.

Step 3: Converting the Path Diagram into a Set of Structural Equations and Measurement Equations

In step 3, the relationships depicted in path diagrams are described in more formal terms. This is achieved through a series of equations that define (1) the structural equations linking the theoretical constructs, (2) the measurement model specifying which variables measure which constructs, and (3) a set of matrices indicating the hypothesized correlations among constructs or variables.

(a) Structural Model

The structural model encapsulates all theoretically postulated direct and indirect relationships among variables, as observed in the path diagram:

$$\underset{(m\times 1)}{\eta} = \underset{(m\times m)}{B}\,\underset{(m\times 1)}{\eta} + \underset{(m\times n)}{\Gamma}\,\underset{(n\times 1)}{\xi} + \underset{(m\times 1)}{\zeta} \qquad (7.11)$$

where η is a vector of endogenous latent variables, ξ is a vector of exogenous latent variables, ζ is a vector of white noise disturbances, while B and Γ are matrices of correlation coefficients between endogenous and exogenous constructs, and exogenous and endogenous constructs, respectively.

(b) The Measurement Model

The measurement model specifies the rules of correspondence between manifest and latent variables. The equations for the measurement model are as follows:

$$\underset{(p\times 1)}{y} = \underset{(p\times m))}{\Lambda_y}\,\underset{(m\times 1)}{\eta} + \underset{(p\times 1)}{\varepsilon} \qquad (7.12)$$

$$\underset{(q\times 1)}{x} = \underset{(q\times n)}{\Lambda_x}\,\underset{(n\times 1)}{\xi} + \underset{(q\times 1)}{\delta} \qquad (7.13)$$

The entries in the Λ_x and Λ_y matrices are factor loading to be empirically estimated, while ε and δ are uncorrelated measurement errors, assumed to be multinormally distributed.

In the above equations, m, n, p, and q, must be read as follows:

m = the number of exogenous constructs,

n = the number of endogenous constructs,

p = the number of exogenous construct indicators, and

q = the number of endogenous construct indicators.

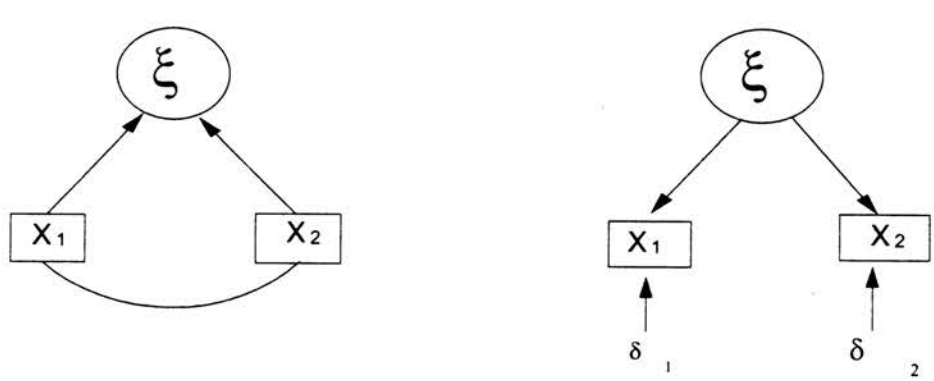
The covariance matrix of the observed indicators y and x, implied by equations (7.11) through (7.13), is given by:

$$\Sigma = \begin{bmatrix} \Lambda_y(I-B)^{-1}(\Gamma\Phi\Gamma' + \Psi)\left[(I-B)^{-1}\right]'\Lambda_y' + \Theta_\varepsilon & \Lambda_y(I-B)^{-1}\Gamma\,\Phi\,\Lambda_x' \\ \Lambda_x\Phi\,\Gamma'\left[(I-B)^{-1}\right]\Lambda_y' & \Lambda_x\Phi\,\Lambda_x' + \Theta_\delta \end{bmatrix}$$

where Φ, Ψ, Θ_ε, and Θ_δ are all covariance matrices. In particular, Φ contains the covariances among the exogenous constructs. Ψ contains the covariances among the exogenous constructs, and Θ_ε and Θ_δ are the covariance matrices of the measurement errors ε and δ, respectively. In addition to the structural and measurement models, correlations between the exogenous constructs, or between the endogenous constructs can also be specified.

Relevant as it is to the model developed in this study, it should be noted that the direction of causality between measures and independent latent variables can either be from the first towards the latter, or the opposite. Bollen (1989, pp. 64-67, 222) distinguishes between cause and effect indicators. Cause indicators are observed variables that are assumed to cause a latent variable. For effect indicators the latent variable causes the observed variable. The following figure A-Three.2 illustrates these two families of indicators.

Figure A-Four.2. Cause and Effect Indicators



Cause Indicators

Effect Indicators

Step 4: Choosing the Input Matrix Type and Estimating the Proposed Model

Structural equation models do not use as their input individual observations but rather the covariances or correlations between the indicators specified in the model. Thus, testing the data for outliers and for meeting certain criteria is done separately.

The choice between the variance/covariance and correlation matrices as input for the estimation of the model depends upon several considerations. In general, the variance/covariance matrix should be employed whenever a theory is to be tested, as the variance/covariance matrix satisfy the assumptions of methodology and is the appropriate form of the data for validating causal relationships.

Correlation coefficients are more appropriate when only the patterns of relationships are of interest. However, the nature of the initial, raw data, determines to a great extent the type of input matrix to be used. The most widely used means for computing the correlations or covariances between observed variables is the Pearson product-moment correlation. However, Pearson's r can be used only when both variables are continuous. Often, as in the model developed in this research, this is not the case. Therefore, when one or both variables are not continuous, alternative correlation coefficients must be used.

If both variables are polychotomous (ordinal), then the polychoric correlation is appropriate. If both variables are binary, then the tetrachoric correlation should be used. When one variable is continuous while the other is measured on the ordinal scale, the polyserial correlation is suitable. Finally, if a continuous variable is related to a binary one, the biserial correlation is the most appropriate.

Sample Size Considerations

While there is no correct sample size, recommendations are for a size between 100 to 200 (Hoetler 1983). Another rule of thumb widely used in structural equation modeling, is that a minimum of five observation must be used for each estimated parameter.

Model Estimation

The estimation of the structural equation model involves the comparison of the model-implied variances and covariances of the observed indicators (matrix Σ) to the variances and covariances calculated from the observed indicators contained in a matrix **S**. The most commonly used estimation method is that of Maximum Likelihood where the following loss function is minimized (Bollen 1989):

$$F_{ML} = tr\left(S\ \Sigma^{-1}\right) + \log\left|\Sigma\right| - \log\left|S\right| - (p+q) \qquad (7.15)$$

Empirical estimation involves the choice of a parameter vector so that the implied covariance matrix Σ is close to the sample covariance matrix **S**. If specified model and estimates provide a perfect fit (i.e. **S** = Σ), then $F_{ML} = 0$.

To estimate the structural equation model, several computer programs have been developed. For this research, LISREL was chosen as the most widely used software with a high degree of user-friendliness in its latest, for-windows, edition (LISREL 8.0 for Windows).

Step 5: Assessing the Identification of the Model Equations

An identification problem arises whenever the proposed model is unable to generate unique estimates. This issue is similar to the problem of "more unknowns than equations" in algebra. When the parameters to be estimated are more than the equations, then the model is called underidentified. When the number of parameters is equal to the number of equations, the model is called "just identified," while if the number of parameters is less than the number of equations, the model is said to be overidentified.

In case results are obtained, possible symptoms of an identification problem include:

(i) very large standard errors for one or more coefficients,

(ii) the inability of the program to invert the information matrix,

(iii) wildly unreasonable estimates or impossible estimates such as negative error variances, or

(iv) high correlations (more than ± .90) among the estimated coefficients.

Several alternative methods for testing whether a model is identified exist. LISREL performs a simple test for identification, that can be used as a first indicator of whether the estimated model is identified. If an identification problem is confirmed, three sources must be checked:

(i) a large number of estimated coefficients relative to the number of covariances or correlations, indicated by small number of degrees of freedom,

(ii) the use of reciprocal effects, or

(iii) failure to fix the scale of a construct.

When an identification problem exists, a structured process must be followed: constraints should be added[67] to the model, successively, until the problem disappears.

Step 6: Evaluating the Results for Goodness-of-Fit

The assumptions underlying structural equation modeling are summarized in Table A-Three.1, below.

Table A-Three.1. Assumptions of Structural Equation Models

- Independent observations
- Random Sampling of Respondents
- Linearity of all relationships
- Multivariate normality
- No strong kurtosis (skewness) in the data

Data must be evaluated before the estimation of the model proceeds. A lack of multivariate normality is particularly troublesome because it substantially inflates the chi-square statistic and creates upward bias in critical values for determining coefficient significance. PRELIS, a software that accompanies LISREL has been used in this study for evaluating the data, before the estimation of the models.

After the data have been checked for satisfying the aforementioned assumptions, the results are first examined for offending estimates. Examples of offending estimates include (1) negative error variances or non-significant error variances for any construct,

[67] That is, some of the estimated coefficients must be eliminated.

(2) standardized coefficients that exceed or are very close to 1.0, or (3) very large standard errors associated with any estimated coefficient.

In case any of these problems occurs, first any identification problems must be corrected, as explained earlier. Then, if the estimation has generated negative error variances[68], the offending error variances must be fixed to a very small positive value (e.g., .005). However, this must be considered when the results are interpreted. If correlations in the standardized solution are greater than 1.0, or two estimates are highly correlated, one of the constructs must be eliminated.

After checking for offending estimates, the overall fit of the model must be assessed. Three generic goodness-of-fit measures exist;

(a) absolute fit measures: Likelihood ratio chi-square statistic, Non-centrality and scaled non-centrality parameter, Goodness-of-fit index[69], Root mean square residual, Root mean square error of approximation, and Expected cross-validation index;
(b) incremental fit measures: Adjusted goodness-of-fit index, and Normed fit index; and
(c) parsimonious fit measures: Parsimonious normed fit index, parsimonious goodness-of-fit index, Normed chi-square, and Akaike information criterion.

Absolute fit measures make no adjustment for the degree of "overfitting that might occur, while incremental fit measures compare the proposed model to a comparison model specified by the researcher. Finally, parsimonious fit measures compare models with different numbers of estimated coefficients to determine the

[68] Called Heywood Cases.
[69] The goodness-of-fit index is provided by LISREL, and most other software programs. It ranges from 0 (poor fit) to 1.0 (perfect fit) and represents the overall degree of fit (the squared residuals from prediction compared with the actual data).

amount of fit achieved by each estimated coefficient. Hair et al. (1995) recommend that more than one of the above measures should be used in evaluating the overall model fit.

The next step is to measure the fit of the model's components; its measurement and structural parts. With respect to the measurement model, the unidimensionality, reliability, and validity of the measurement of each construct are assessed. Unidimensionality is an assumption underlying the calculation of reliability and is demonstrated when the indicators of a construct have acceptable fit on a single-factor model. Reliability, checked through Cronbach's alpha (α)[70], is measure of internal consistency of the construct indicators, depicting the degree to which they "indicate" the common latent construct. Validity is the extent to which the indicators "accurately" measure what they are supposed to measure. Several measures of validity are given in Bollen (1989). The fit of the structural model is evaluated in ways similar to those used in standard regression analysis, and thus, they are omitted.

Step 7: Making the Indicated Modifications to the Model if Theoretically Justified

Once the model is deemed acceptable, the possibility of model modifications, for improving the theoretical explanation or the goodness-of-fit, should be examined in this last step of structural equation modeling.

Modifications should be made with care and only after obtaining theoretical justification for what empirically is deemed significant. LISREL output provides a

[70] Cronbach's alpha is given in the LISREL output. A value above 0.70 is considered very good, although values below 0.70 have been deemed acceptable.

modification index, which measures the reduction in chi-square (χ^2) that would occur if the coefficient was estimated. A value greater or equal to 3.84 indicates that the coefficient should be estimated.

APPENDIX FOUR

LISREL PROGRAMS

```
L I S R E L  8.20

BY

Karl G. Jöreskog and Dag Sörbom

This program is published exclusively by
Scientific Software International, Inc.
7383 N. Lincoln Avenue, Suite 100
Chicago, IL 60646-1704, U.S.A.
Phone: (800)247-6113, (847)675-0720, Fax: (847)675-2140
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Website: www.ssicentral.com
```

Program for Model H1:

The following lines were read from file **C:\PRSSUR~1\LATNEW5.LPJ:**

```
WLS, CAUSE, INCLUDING SEPKPOOL
TI LATNEW5 MODEL
DA NI=6 NO=127 NG=1 MA=PM
LA
MEMBPOL MKTGAGR TRANSFER SEPKPOOL IPMNEW1 OWNERS
PM FI=C:~1.COR SY
AC FI=C:~1.ACP
SE
5 6 1 2 3 4 /
MO NX=4 NY=2 NE=1 LY=FU,FI GA=FU,FI PH=SY,FR PS=DI,FR TE=DI,FR
LE
INCENT
FI PS(1,1)
FR GA(1,1) GA(1,2) GA(1,3) GA(1,4)
VA 1.0000 LY(1,1) LY(2,1)
PD
OU ME=WL PC RS EF SS SC XM ND=4 IT=550 AD=550

                    Number of Input Variables  6
                    Number of Y - Variables    2
                    Number of X - Variables    4
```

```
Number of ETA - Variables  1
Number of KSI - Variables  4
Number of Observations   127
```

Program for Model Ho:

The following lines were read from file **A:\AUG13A.LPJ:**

```
TI WLS
DA NI=6 NO=127 NG=1 MA=PM
LA
MEMBPOL MKTGAGR TRANSFER SEPKPOOL IPM OWNERS
CM FI=A:SY
AC FI=A:
SE
5 6 1 2 3 4 /
MO NX=4 NY=2 NE=1 LY=FU,FI GA=FU,FI PH=SY,FR PS=DI,FR TE=DI,FR
LE
INCENT
FI PS(1,1)
FR GA(1,1) GA(1,2) GA(1,3)
FI GA(1,4)
VA 1.0000 LY(1,1) LY(2,1)
PD
OU ME=WL ND=4 IT=550 AD=550
```

```
Number of Input Variables  6
Number of Y - Variables    2
Number of X - Variables    4
Number of ETA - Variables  1
Number of KSI - Variables  4
Number of Observations   127
```

APPENDIX FIVE

SELECTED LISREL OUTPUTS

L I S R E L 8.20

BY

Karl G. Jöreskog and Dag Sörbom

Output for Model H1:

Correlation Matrix to be Analyzed

	IPMNEW1	OWNERS	MEMBPOL	MKTGAGR	TRANSFE	SEPK POOL
IPMNEW1	1.0000					
OWNERS	0.7432	1.0000				
MEMBPOL	-0.9376	-0.9681	1.0000			
MKTGAGR	0.8091	0.8725	-0.7728	1.0000		
TRANSFER	0.7557	0.7809	-0.7995	0.6565	1.0000	
SEPKPOOL	0.4963	0.5732	-0.5346	0.6618	0.5145	1.00

Parameter Specifications

GAMMA

	MEMBPOL	MKTGAGR	TRANSFER	SEPKPOOL
INCENT	1	2	3	4

PHI

	MEMBPOL	MKTGAGR	TRANSFER	SEPKPOOL
MEMBPOL	5			
MKTGAGR	6	7		
TRANSFER	8	9	10	
SEPKPOOL	11	12	13	14

THETA-EPS

IPMNEW1	OWNERS
15	16

Number of Iterations = 23

LISREL Estimates (Weighted Least Squares)

LAMBDA-Y

	INCENT
IPMNEW1	1.0000
OWNERS	1.0000

GAMMA

	MEMBPOL	MKTGAGR	TRANSFER	SEPKPOOL
INCENT	-0.5454	0.4112	0.1679	-0.0269
	(0.1305)	(0.1461)	(0.1105)	(0.0754)
	-4.1798	2.8137	1.5197	-0.3571

Covariance Matrix of ETA and KSI

	INCENT	MEMBPOL	MKTGAGR	TRANSFER	SEPKPOOL
INCENT	0.8117				
MEMBPOL	-0.7727	1.0850			
MKTGAGR	0.7119	-0.3233	1.0483		
TRANSFER	0.6246	-0.3077	0.7412	1.0081	
SEPKPOOL	0.4556	-0.1336	0.7368	0.6359	1.0002

PHI

	MEMBPOL	MKTGAGR	TRANSFER	SEPKPOOL
MEMBPOL	1.0850			
	(0.0826)			
	13.1348			
MKTGAGR	-0.3233	1.0483		
	(0.3636)	(0.0870)		

	-0.8891	12.0433		
TRANSFER	-0.3077	0.7412	1.0081	
	(0.3328)	(0.0629)	(0.0890)	
	-0.9246	11.7897	11.3225	
SEPKPOOL	-0.1336	0.7368	0.6359	1.0002
	(0.3148)	(0.0675)	(0.0870)	(0.0891)
	-0.4243	10.9229	7.3077	11.2273

PSI

INCENT
0.0050

Squared Multiple Correlations for Structural Equations

INCENT
0.9938

THETA-EPS

IPMNEW1	OWNERS
0.1883	0.1883
(0.0944)	(0.0944)
1.9956	1.9956

Squared Multiple Correlations for Y - Variables

IPMNEW1	OWNERS
0.8117	0.8117

Goodness of Fit Statistics

```
Degrees of Freedom = 5
Minimum Fit Function Chi-Square = 9.3848 (P = 0.09467)
Estimated Non-centrality Parameter (NCP) = 4.3848
90 Percent Confidence Interval for NCP = (0.0 ; 17.1453)

Minimum Fit Function Value = 0.07448
Population Discrepancy Function Value (F0) = 0.03480
90 Percent Confidence Interval for F0 = (0.0 ; 0.1361)
Root Mean Square Error of Approximation (RMSEA) = 0.08343
90 Percent Confidence Interval for RMSEA = (0.0 ; 0.1650)
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.2092

Expected Cross-Validation Index (ECVI) = 0.3285
90 Percent Confidence Interval for ECVI = (0.2937 ; 0.4297)
ECVI for saturated Model = 0.3333
ECVI for Independence Model = 26.8810

Chi-Square for Independence Model with 15 Degrees of Freedom =
```

3375.0054
Independence AIC = 3387.0054
Model AIC = 41.3848
Saturated AIC = 42.0000
Independence CAIC = 3410.0705
Model CAIC = 102.8918
Saturated CAIC = 122.7279

Root Mean Square Residual (RMR) = 0.1957
Standardized RMR = 0.1874
Goodness of Fit Index (GFI) = 0.9972
Adjusted Goodness of Fit Index (AGFI) = 0.9883
Parsimony Goodness of Fit Index (PGFI) = 0.2374

Normed Fit Index (NFI) = 0.9972
Non-Normed Fit Index (NNFI) = 0.9961
Parsimony Normed Fit Index (PNFI) = 0.3324
Comparative Fit Index (CFI) = 0.9987
Incremental Fit Index (IFI) = 0.9987
Relative Fit Index (RFI) = 0.9917

Critical N (CN) = 203.5796

Fitted Covariance Matrix

	IPMNEW1	OWNERS	MEMBPOL	MKTGAGR	TRANSFE	SEPKPOOL
IPMNEW1	1.0000					
OWNERS	0.8117	1.0000				
MEMBPOL	-0.7727	-0.7727	1.0850			
MKTGAGR	0.7119	0.7119	-0.3233	1.0483		
TRANSFER	0.6246	0.6246	-0.3077	0.7412	1.0081	
SEPKPOOL	0.4556	0.4556	-0.1336	0.7368	0.6359	1.0002

Fitted Residuals

	IPMNEW1	OWNERS	MEMBPOL	MKTGAGR	TRANSFE	SEPKPOOL
IPMNEW1	0.0000					
OWNERS	-0.0685	0.0000				
MEMBPOL	-0.1649	-0.1954	-0.0850			
MKTGAGR	0.0972	0.1606	-0.4494	-0.0483		
TRANSFER	0.1311	0.1562	-0.4918	-0.0847	-0.0081	
SEPKPOOL	0.0408	0.1177	-0.4010	-0.0750	-0.1214	-0.0002

Summary Statistics for Fitted Residuals

Smallest Fitted Residual = -0.4918
Median Fitted Residual = -0.0483
Largest Fitted Residual = 0.1606

Stemleaf Plot

```
- 4|950
- 2|0
- 0|62987751000
  0|402366
```

Correlation Matrix of Parameter Estimates

	GA 1,1	GA 1,2	GA 1,3	GA 1,4	PH 1,1	PH 2,1
GA 1,1	1.0000					
GA 1,2	0.3332	1.0000				
GA 1,3	0.3959	-0.1101	1.0000			
GA 1,4	-0.0982	-0.5121	0.1773	1.0000		
PH 1,1	0.4521	0.1731	0.0590	-0.2177	1.0000	
PH 2,1	-0.3633	0.4192	0.2548	0.0730	-0.1419	1.0000
PH 2,2	-0.0843	-0.6727	0.3467	0.6067	-0.0879	-0.0765
PH 3,1	-0.3651	0.3226	0.3567	0.0817	-0.1782	0.9392
PH 3,2	-0.0058	0.4509	0.4391	-0.0051	-0.1437	0.7431
PH 3,3	-0.0246	0.1175	-0.3084	0.1119	-0.0143	-0.0125
PH 4,1	-0.3898	0.2986	0.2580	0.1861	-0.1488	0.9418
PH 4,2	-0.0884	0.4454	0.2741	0.2229	-0.1236	0.8164
PH 4,3	-0.0592	0.3409	0.4554	0.2076	-0.1534	0.7628
PH 4,4	-0.0048	-0.0206	-0.0127	0.0719	-0.0004	-0.0003
TE 1,1	-0.0358	-0.0302	0.0493	0.0569	0.0747	0.1161
TE 2,2	-0.0358	-0.0302	0.0493	0.0569	0.0747	0.1161

Correlation Matrix of Parameter Estimates

	PH 2,2	PH 3,1	PH 3,2	PH 3,3	PH 4,1	PH 4,2
PH 2,2	1.0000					
PH 3,1	-0.0961	1.0000				
PH 3,2	-0.0775	0.7737	1.0000			
PH 3,3	-0.0077	-0.0157	-0.0126	1.0000		
PH 4,1	-0.0803	0.9327	0.6711	-0.0131	1.0000	

PH 4,2	-0.0667	0.7524	0.8291	-0.0109	0.7975
1.0000					
PH 4,3	-0.0827	0.8245	0.9002	-0.0135	0.7848
0.8855					
PH 4,4	-0.0002	-0.0004	-0.0003	0.0000	-0.0003
0.0003					
TE 1,1	0.0403	0.1141	0.0518	0.0066	0.1368
0.0743					
TE 2,2	0.0403	0.1141	0.0518	0.0066	0.1368
0.0743					

Correlation Matrix of Parameter Estimates

	PH 4,3	PH 4,4	TE 1,1	TE 2,2
PH 4,3	1.0000			
PH 4,4	-0.0003	1.0000		
TE 1,1	0.0712	0.0002	1.0000	
TE 2,2	0.0712	0.0002	0.1086	1.0000

Standardized Solution

LAMBDA-Y

	INCENT
IPMNEW1	0.9009
OWNERS	0.9009

GAMMA

	MEMBPOL	MKTGAGR	TRANSFER	SEPKPOOL
INCENT	-0.6305	0.4673	0.1871	-0.0299

Correlation Matrix of ETA and KSI

	INCENT	MEMBPOL	MKTGAGR	TRANSFER	SEPKPOOL
INCENT	1.0000				
MEMBPOL	-0.8234	1.0000			
MKTGAGR	0.7718	-0.3031	1.0000		
TRANSFER	0.6905	-0.2942	0.7210	1.0000	
SEPKPOOL	0.5056	-0.1282	0.7195	0.6333	1.0000

PSI

INCENT
0.0062

Regression Matrix ETA on X (Standardized)

	MEMBPOL	MKTGAGR	TRANSFER	SEPKPOOL
INCENT	-0.6305	0.4673	0.1871	-0.0299

Completely Standardized Solution

LAMBDA-Y

	INCENT
IPMNEW1	0.9009
OWNERS	0.9009

GAMMA

	MEMBPOL	MKTGAGR	TRANSFER	SEPKPOOL
INCENT	-0.6305	0.4673	0.1871	-0.0299

Correlation Matrix of ETA and KSI

	INCENT	MEMBPOL	MKTGAGR	TRANSFER	SEPKPOOL
INCENT	1.0000				
MEMBPOL	-0.8234	1.0000			
MKTGAGR	0.7718	-0.3031	1.0000		
TRANSFER	0.6905	-0.2942	0.7210	1.0000	
SEPKPOOL	0.5056	-0.1282	0.7195	0.6333	1.0000

PSI

INCENT
0.0062

THETA-EPS

IPMNEW1	OWNERS
0.1883	0.1883

Regression Matrix ETA on X (Standardized)

	MEMBPOL	MKTGAGR	TRANSFER	SEPKPOOL
INCENT	-0.6305	0.4673	0.1871	-0.0299

Total and Indirect Effects

Total Effects of X on Y

	MEMBPOL	MKTGAGR	TRANSFER	SEPKPOOL
IPMNEW1	-0.5454	0.4112	0.1679	-0.0269
	(0.0116)	(0.0130)	(0.0098)	(0.0067)
	-46.9176	31.5835	17.0583	-4.0088
OWNERS	-0.5454	0.4112	0.1679	-0.0269
	(0.0116)	(0.0130)	(0.0098)	(0.0067)
	-46.9176	31.5835	17.0583	-4.0088

```
The Problem used    11640 Bytes (=  0.0% of Available Workspace)
Time used:    1.16 Seconds
```

Output for Model Ho:

Correlation Matrix to be Analyzed

	IPMNEW1	OWNERS	MEMBPOL	MKTGAGR	TRANSFER	SEPK POOL
IPMNEW1	1.0000					
OWNERS	0.7432	1.0000				
MEMBPOL	-0.9376	-0.9681	1.0000			
MKTGAGR	0.8091	0.8725	-0.7728	1.0000		
TRANSFER	0.7557	0.7809	-0.7995	0.6565	1.0000	
SEPKPOOL	0.4963	0.5732	-0.5346	0.6618	0.5145	1.0000

Parameter Specifications

GAMMA

	MEMBPOL	MKTGAGR	TRANSFER	SEPKPOOL
INCENT	1	2	3	0

PHI

	MEMBPOL	MKTGAGR	TRANSFER	SEPKPOOL
MEMBPOL	4			
MKTGAGR	5	6		
TRANSFER	7	8	9	
SEPKPOOL	10	11	12	13

THETA-EPS

IPMNEW1	OWNERS
14	15

Number of Iterations = 21

LISREL Estimates (Weighted Least Squares)

LAMBDA-Y

	INCENT
IPMNEW1	1.0000
OWNERS	1.0000

GAMMA

	MEMBPOL	MKTGAGR	TRANSFER	SEPKPOOL
INCENT	-0.5518	0.3892	0.1701	- -
	(0.1286)	(0.1204)	(0.1084)	
	-4.2911	3.2324	1.5692	

Covariance Matrix of ETA and KSI

	INCENT	MEMBPOL	MKTGAGR	TRANSFER	SEPKPOOL
INCENT	0.8099				
MEMBPOL	-0.7654	1.0787			
MKTGAGR	0.7106	-0.3085	1.0644		
TRANSFER	0.6235	-0.2947	0.7416	1.0129	
SEPKPOOL	0.4580	-0.1071	0.7437	0.6435	1.0000

PHI

	MEMBPOL	MKTGAGR	TRANSFER	SEPKPOOL
MEMBPOL	1.0787			
	(0.0798)			
	13.5135			
MKTGAGR	-0.3085	1.0644		
	(0.3594)	(0.0727)		
	-0.8583	14.6392		
TRANSFER	-0.2947	0.7416	1.0129	

	(0.3291)	(0.0629)	(0.0884)	
	-0.8954	11.7926	11.4603	
SEPKPOOL	-0.1071	0.7437	0.6435	1.0000
	(0.3022)	(0.0641)	(0.0835)	(0.0891)
	-0.3543	11.6080	7.7069	11.2250

PSI

INCENT
0.0050

Squared Multiple Correlations for Structural Equations

INCENT
0.9938

THETA-EPS

IPMNEW1	OWNERS
0.1901	0.1901
(0.0941)	(0.0941)
2.0197	2.0197

Squared Multiple Correlations for Y - Variables

IPMNEW1	OWNERS
0.8099	0.8099

Goodness of Fit Statistics

```
Degrees of Freedom = 6
Minimum Fit Function Chi-Square = 9.5371 (P = 0.1455)
Estimated Non-centrality Parameter (NCP) = 3.5371
90 Percent Confidence Interval for NCP = (0.0 ; 16.1192)

Minimum Fit Function Value = 0.07569
Population Discrepancy Function Value (F0) = 0.02807
90 Percent Confidence Interval for F0 = (0.0 ; 0.1279)
Root Mean Square Error of Approximation (RMSEA) = 0.06840
90 Percent Confidence Interval for RMSEA = (0.0 ; 0.1460)
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.2988

Expected Cross-Validation Index (ECVI) = 0.3138
90 Percent Confidence Interval for ECVI = (0.2857 ; 0.4136)
ECVI for saturated Model = 0.3333
ECVI for Independence Model = 26.8810

Chi-Square for Independence Model with 15 Degrees of Freedom =
```

```
3375.0054
Independence AIC = 3387.0054
Model AIC = 39.5371
Saturated AIC = 42.0000
Independence CAIC = 3410.0705
Model CAIC = 97.1999
Saturated CAIC = 122.7279

Root Mean Square Residual (RMR) = 0.2027
Standardized RMR = 0.1939
Goodness of Fit Index (GFI) = 0.9972
Adjusted Goodness of Fit Index (AGFI) = 0.9901
Parsimony Goodness of Fit Index (PGFI) = 0.2849

Normed Fit Index (NFI) = 0.9972
Non-Normed Fit Index (NNFI) = 0.9974
Parsimony Normed Fit Index (PNFI) = 0.3989
Comparative Fit Index (CFI) = 0.9989
Incremental Fit Index (IFI) = 0.9990
Relative Fit Index (RFI) = 0.9929

Critical N (CN) = 223.1154
```

Summary Statistics for Fitted Residuals

```
 Smallest Fitted Residual =   -0.5048
   Median Fitted Residual =   -0.0644
  Largest Fitted Residual =    0.1619
```

Stemleaf Plot

```
- 4|063
- 2|0
- 0|73988761000
  0|402366
```

Modification Indices and Expected Change

Modification Indices for LAMBDA-Y

	INCENT
IPMNEW1	0.8763
OWNERS	0.8464

Expected Change for LAMBDA-Y

	INCENT
IPMNEW1	-0.0450
OWNERS	0.0443

Modification Indices for GAMMA

	MEMBPOL	MKTGAGR	TRANSFER	SEPKPOOL
INCENT	- -	- -	- -	0.1876

Expected Change for GAMMA

	MEMBPOL	MKTGAGR	TRANSFER	SEPKPOOL
INCENT	- -	- -	- -	-0.0339

No Non-Zero Modification Indices for PHI

Modification Indices for THETA-EPS

	IPMNEW1	OWNERS
IPMNEW1	- -	
OWNERS	6.2587	- -

Expected Change for THETA-EPS

	IPMNEW1	OWNERS
IPMNEW1	- -	
OWNERS	-0.1757	- -

Modification Indices for THETA-DELTA-EPS

	IPMNEW1	OWNERS
MEMBPOL	0.0355	3.6920
MKTGAGR	0.4960	0.0238
TRANSFER	0.3366	0.0273
SEPKPOOL	1.8333	0.8262

Expected Change for THETA-DELTA-EPS

	IPMNEW1	OWNERS
MEMBPOL	0.0104	-0.0900
MKTGAGR	0.0173	0.0039
TRANSFER	0.0152	-0.0042
SEPKPOOL	-0.0379	0.0232

Standardized Expected Change for GAMMA

	MEMBPOL	MKTGAGR	TRANSFER	SEPKPOOL
INCENT	0.5266	--	--	--

No Non-Zero Modification Indices for PHI

Modification Indices for THETA-EPS

	IPMNEW1	OWNERS
IPMNEW1	--	
OWNERS	6.4438	--

Expected Change for THETA-EPS

	IPMNEW1	OWNERS
IPMNEW1	--	
OWNERS	-0.2015	--

Completely Standardized Expected Change for THETA-EPS

	IPMNEW1	OWNERS
IPMNEW1	--	
OWNERS	-0.2015	--

Modification Indices for THETA-DELTA-EPS

	IPMNEW1	OWNERS
MEMBPOL	0.8710	3.5026
MKTGAGR	0.1328	0.1207
TRANSFER	1.1435	0.6298
SEPKPOOL	2.5325	2.1810

Expected Change for THETA-DELTA-EPS

	IPMNEW1	OWNERS
MEMBPOL	0.0538	-0.0993
MKTGAGR	0.0094	0.0090
TRANSFER	0.0281	-0.0210
SEPKPOOL	-0.0458	0.0429

Completely Standardized Expected Change for THETA-DELTA-EPS

	IPMNEW1	OWNERS
MEMBPOL	0.0538	-0.0993
MKTGAGR	0.0092	0.0088

TRANSFER	0.0282	-0.0210
SEPKPOOL	-0.0458	0.0429

Correlation Matrix of Parameter Estimates

	GA 1,2	GA 1,3	GA 1,4	PH 1,1	PH 2,1	PH 2,2
GA 1,2	1.0000					
GA 1,3	-0.8343	1.0000				
GA 1,4	-0.6558	0.1813	1.0000			
PH 1,1	- -	- -	- -	1.0000		
PH 2,1	-0.3008	0.3588	0.2295	- -	1.0000	
PH 2,2	-0.7856	0.5344	0.5388	- -	0.0080	1.0000
PH 3,1	0.2049	-0.2840	0.0776	- -	0.4234	-0.0233
PH 3,2	0.0027	-0.1407	0.1605	- -	0.3915	0.0558
PH 3,3	0.2293	-0.4889	0.1312	- -	-0.1515	-0.0025
PH 4,1	0.1355	0.1840	-0.5223	- -	0.4611	-0.0089
PH 4,2	-0.0671	0.1392	-0.0759	- -	0.5565	0.0590
PH 4,3	0.1345	-0.1460	-0.0974	- -	0.3068	0.0532
PH 4,4	-0.0005	-0.0002	0.0013	- -	0.0003	0.0000
TE 1,1	-0.0555	0.0412	-0.0239	- -	-0.1691	0.0325
TE 2,2	-0.0555	0.0412	-0.0239	- -	-0.1691	0.0325

Correlation Matrix of Parameter Estimates (continued)

	PH 3,1	PH 3,2	PH 3,3	PH 4,1	PH 4,2	PH 4,3
PH 3,1	1.0000					
PH 3,2	0.5761	1.0000				
PH 3,3	-0.1404	-0.0477	1.0000			
PH 4,1	0.4193	0.1173	-0.1384	1.0000		
PH 4,2	0.3005	0.6278	-0.0541	0.4818	1.0000	
PH 4,3	0.6483	0.7912	-0.0545	0.4391	0.7292	1.0000
PH 4,4	0.0002	0.0001	0.0000	0.0002	0.0001	0.0001
TE 1,1	-0.1877	-0.1734	-0.0028	- 0.0888	-0.1427	-0.1641
TE 2,2	-0.1877	-0.1734	-0.0028	- 0.0888	-0.1427	-0.1641

Correlation Matrix of Parameter Estimates (continued)

	PH 4,4	TE 1,1	TE 2,2
PH 4,4	1.0000		
TE 1,1	0.0000	1.0000	
TE 2,2	0.0000	0.1075	1.0000
wls, cau	se,	all	variables

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VITA

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Constantine Iliopoulos has worked with and for cooperatives in many countries. His interests include: economics of collective action, neo-institutional economics, economics of organization and governance structures, vertical coordination and chain management in agribusiness, rural development, and the art of living.

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