The Complexities of Measuring Free Rider Behavior: Preliminary Musings

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Introduction

The objective of this study is to develop an analytic approach to more accurately capture the multiple dimensions of free riding within large collective action organizations. A Confirmatory Factor Analysis model is used to test for the relative importance and statistical significance of alternative measures of free riding. A member survey of a large agricultural cooperative provides the data for analysis.

Free Riding: A Vaguely Defined Term

The modern study of collective action can be traced to Olson (1965), who challenged the prevailing paradigm that groups behaved like individuals and would organize to create collective benefits when the need arose. Olson's two primary propositions were that 1) the size of the group had a significant impact on a group's capacity to organize and provide collective benefits and 2) it was rational for individuals within large groups to lack the motivation to voluntarily contribute resources towards producing the desired collective goods. Olson used the terms *collective good* and *public good* interchangeably and focused on the inability of the group to exclude the benefits of collective action from those who did not contribute. Although the term *free riding* was never used within Olson's discussion, the concept that individuals could receive the benefits from group activity without bearing their proportional share of the costs was a

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central theme and is commonly referred to as *free riding* or *the free rider problem*. Thus, the free rider problem has become closely associated with collective action and is a primary concern for organizations attempting to provide collective goods.

Unfortunately, the term free riding does not have a precise definition or consistent usage within the social science literature. McMillan (1979) discusses alternative meanings of the free rider problem within the context of pure public goods; "The free-rider problem is in fact not one, but three separate problems. In order for a Pareto optimum to be reached in an economy with a public good, there is a need, firstly, for consumers to contribute enough revenue to pay for an optimal quantity of the public good. Secondly, it is necessary for agents to reveal their preferences for the public good (so that it can be known what is an optimal quantity of the public good). Thirdly, a different kind of problem arises when the number of agents consuming the public good becomes large."

Sandler (1992) points out, "At times, free riding refers to the sub-optimality that often characterizes the Nash or non-cooperative equilibrium associated with the provision of a public good. At other times, especially with respect to empirical studies, it relates to the inverse relationship between an agent's contribution and those of the other agents. Free riding also relates to the failure of individuals to reveal their true preferences for the public good through their contributions. Finally, it denotes the tendency for marginal and average contributions to decline with group size."

Free riding behavior can also be found within the organizational economics literature. Alchian and Demstez (1972) used the term *shirking* to refer to free riding behavior within team production activities. They argued that because it was difficult to measure the marginal contribution of each individual within a team production system, team members have an

incentive to shirk. And, because marginal contributions were difficult to measure, market contracts for labor could not properly reward each individual's marginal contribution to the production process. Their solution was to assign a monitor, or manager, to oversee the production process. The monitor was given authority to expel team members who did not perform and would receive the residual benefits from the team production as compensation for their monitoring and enforcement activities.

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

The combined influence of the principle-agent problem and a large group of individual investors has lead to the development of a rich and diverse set of research findings within the corporate finance and corporate governance literatures. As Megginson (1996) points out; "Clearly, with this many atomistic shareholders, no single 'owner' has the incentive to closely monitor corporate management, nor can that shareholder act unilaterally even if he or she is convinced that action is called for. This is a classic *collective action* problem. It is in the group's best interest for action to be taken (to monitor and discipline management), but it is in no individual group member's rational self-interest to precipitate action since he or she bears all of the cost of taking action, but the benefits are dispersed among the group."

Both the corporate finance and corporate governance literatures focus on how market based solutions can alleviate these problems within publicly traded corporations. There is little empirical literature informing the solutions to the free rider problems within other business organizations, particularly patron owned firms.

Approaches to Studying Collective Action Groups

Game theory has become the most often used technique to study the problems facing collective action groups, with the *prisoner's dilemma game* being used as a starting point. Although the prisoner's dilemma game does not formally model the free riding behavior described by Olson, it does illustrate how individuals pursuing their own interests can achieve outcomes that are sub-optimal when evaluated at the group level. Hechathorn (1996) enumerates five alternative games which have been used to analyze the coordination problems within collective action activities. They are; 1) the prisoner's dilemma game, 2) the assurance game, 3) the chicken game, 4) the altruist's dilemma game and 5) the privileged game.

One of the early findings from analyzing the prisoner's dilemma game was that playing an infinitely repeated game, rather than a one shot game, can result in a solutions which provide an optimal outcome at the group level[2]. The implication is that consistent, repeated interaction by the players is an important criterion for overcoming group coordination problems.

Ostrom et.al (1994) review alternative game structures and compare these games to a set of laboratory experiments and research case studies of common-pool resource situations. This comparison revealed that the rules of the game, or institutional structure, governing player communication and the ability to sanction non-collaborative players had a significant influence

[2] Axelrod (1984) found that individuals playing a 'tit-for-tat' strategy within a two-person, full information infinitely repeated game could achieve higher payoffs than a variety of alternative strategies.

on the group's ability to coordinate player's actions. The implication is that a player's interest in communicating with other players and/or sanctioning non-collaborative players may also be a dimension of free riding behavior.

Multiple Dimensions to Free Riding Behavior

Although the general concept of free riding is consistent across the various uses, the individual's behavior is context specific. Within a public goods context, free riding emphasizes *consumption based* behavior and refers to an under provision of resources and a failure by beneficiaries to reveal their true preferences for the public good. Within an organizational economics context, free riding emphasizes *production based* behavior and refers to shirking by input providers and hired management, as well as the monitoring activities of the organization's "owners". And within a game theory context free riding reflects *interaction based* behavior, with the effort made to influence non-collaborative players through repeated communication and sanctioning becoming a measure.

Ostrom (2003) discusses similar concepts while outlining the collective action problems in common pool resource (CPR) situations. Ostrom agues that both the type of production function associated with the CPR and the allocation function used to distribute the resulting benefits and costs to group members influence the incentives participants face. Although there is no formal discussion of different types of free riding behavior, the importance of integrating production attributes, allocation or "consumption" attributes and low cost monitoring and sanctioning procedures was discussed.

The Conceptual Model

Rather than game theory or experimentation, this paper attempts to inform the free rider issue in patron owned firms through a multivariate approach. Survey data is analyzed to utilize a Confirmatory Factor Analysis model. Confirmatory Factor Analysis (CFA) is within the family of multivariate latent variable modeling techniques[3], but is different from the more common exploratory factor analysis (EFA). Within CFA, the researcher specifies the relationships between the defined variables based upon theoretical justification, and then tests how well the relationships described in the model compare to the relationships contained in the data set. Within EFA, the chosen algorithm[4] searches for associations that minimize the difference between the relationships contained within the data and those implied by alternative model configurations, irrespective of any theoretical justification.

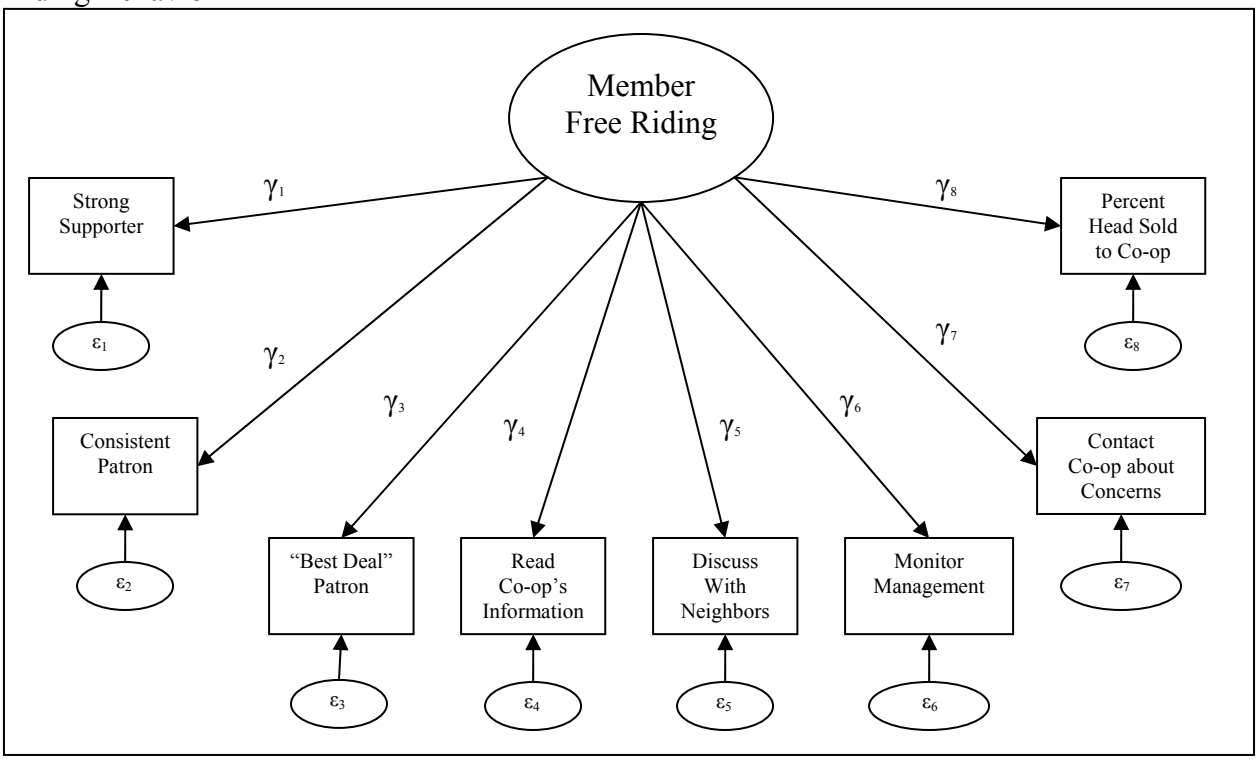
Figure 1 is a path diagram of the CFA model tested. The large oval indicates the latent, or unobservable, free riding variable[5]. The squares indicate the manifest, or observable variables. The single headed arrows, labeled γ_1 to γ_8, represent the regression coefficients from the latent variable to the manifest variables.

Conceptually, the exogenous free riding latent variable has a direct effect on the endogenous manifest variables. Thus, the common co-variation between the manifest variables is a direct result of the unobservable latent variable[6]. A CFA model allows for multiple

[3] Some authors use the term Structural Equation Modeling (SEM) rather than the more general term *latent variable models*.
[4] Common algorithms include Viramax, Quartimax, Eqamax and Promax.
[5] This approach does not start with a specific definition of free riding, but rather attempts to tease out a description based upon the situation and data analysis.
[6] Some authors have used the terms *measurement variables* or *indicator variables* to describe the role these manifest variables play within a CFA model.

indicators or measures to be used for one common construct[7]. Because the manifest variables are endogenous, there is an error term associated with each variable, labeled ε_1 to ε_8. These error terms contain both the measurement error for the respective manifest variable and the variance of the manifest variable not associated with the latent variable.

Figure 1: Conceptual Confirmatory Factor Analysis Model Testing Alternative Measures of Free Riding Behavior



There were eight manifest measurement variables used within this model. Each variable is coupled with a vector of survey questions distributed to members of a large, multi-commodity agricultural marketing cooperative.

[7] Additional presentations of basic CFA modeling can be found in Pedhazur (1997) and Kline (2005), while Lohlen (2003), Mueller (1996) and Wansbeek and Meijer (2000) present a more detailed discussion of CFA and other related multivariate latent variable techniques.

The first two variables, *Strong Supporter* (γ_1) and *Consistent Patron* (γ_2), measures the respondents own assessment of their general support for the organization and level of repeat business, respectively, which is analogous to a repeated game. The **"***Best Deal" Patron* (γ_3) variable measures how sensitive a member's patronage is to changes in relative prices between the cooperative and other firms within the industry, which is an alternative measure of consistent patronage. The *Read Cooperative's Information* (γ_4) variable measures how regularly the member read information provided by the cooperative concerning its operations and activities, which is one form of communication.

Variable five, *Discuss With Neighbors* (γ_5), measures how regularly the member discusses the activities of the cooperative with their neighbors, which is analogous to communication between players in a game theory experiment. Variable six, *Monitor Management* (γ_6), measures how actively the member monitors the management of the cooperative. The seventh variable, *Contact Cooperative about Concerns* (γ_7), is a dummy variable used to determine if the member contacts individuals within the cooperative when the member has a concern about how the cooperative is being operated, which is a proxy for conveying preferences. The final variable is *Percent Head Sold to Cooperative* (γ_8), which is a calculated value constructed from a series of questions concerning total annual sales volume relative to the annual sales made to the cooperative, and is a measure of resource contributions made toward the production of the collective good.

Patron Owned Firms as a Unit of Analysis

Patron owned firms have been described as private organizations which focus on creating user benefits, and are also owned and controlled by users (Hansmann, 1996). Cooperatives are commonly listed as one type of collective action and member free riding is often discussed as a problem within cooperative business organizations (Cook, 1995; Cook and Iliopoulos 2000). Agricultural cooperatives are some of the oldest and most common patron owned organizations within the United States (Ingalsbe and Groves, 1989; Fairbairn, 2004).

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

Shortly after Nourse's paper, Sapiro (1993, reprinted from 1923) argued that the primary objective of an agricultural cooperative should be to enhance farm level product prices by establishing a dominant presence in the market place and should attempt to extract favorable prices through group selling. This strategy, which exploited institutional support[8], would be implemented through tightly controlled long-term member marketing contracts. Saprio also emphasized that the cooperative should only be owned by producer/members. This strategy could result in either the creation of club goods or pure public goods, and would depend upon the

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

number and size of producers who joined the cooperative and the competitive response of other firms in the market.

Although there are a variety of cooperative business models (Cook and Chaddad, 2004) with a range of potential business strategies (Peterson and Anderson, 1996) that have emerged since Nourse's and Sapiro's presentations, agricultural cooperatives continue to create various forms of collective benefits. And, as Cook (1995) notes, free riding is an issue within all types of cooperative business structures, but is most significant in those exhibiting open membership policies and operating in atomistically competitive markets.

The Selected Cooperative: United Producers, Inc.

The cooperative chosen for this study is United Producers, Inc. (UPI). UPI is a livestock marketing cooperative, headquartered in Columbus, Ohio, which owns and operates 19 weekly livestock auctions and 23 animal collection points for direct livestock movement within six states[9]. It provides local market outlets for beef cattle, dairy cattle and replacement heifers, hogs, sheep and goats. The cooperative also provides farmers access to agricultural loans, price risk management services and production consulting services.

UPI was chosen for a unit of analysis for the following reasons. First, the parent cooperative was originally formed to "provide livestock producers access to competitive markets", which continues to be the central theme within their current mission statement[10]. This objective is consistent with Nourse's view that the primary function of a cooperative is to act as a competitive yardstick. Second, the cooperative had 51, 423 individual farmers or farm entities listed as patron/members in 2005, which is interpreted as a large group.

[9] Ohio, Illinois, Indiana, Missouri, Michigan and Kentucky.
[10] Personal discussion with Dennis Bolling, President & CEO of United Producers Inc.

Third, it has an "open membership" policy with very few entry and exit barriers. To become a member of the cooperative an individual, or farm entity, must sell livestock through one of the auction facilities or collection points. A small fee is charged for each animal sold. This fee, called a per unit capital retain, is used as equity capital by the cooperative[11]. After a four year period the retained fees are returned to the member at book value, on a revolving basis. There is also an upper limit of $2,500 per member on total accumulated retained investment at any time during the four year period. Under this system, the member's patronage provides two important resources needed by the cooperative to create collective benefits. First, member patronage results in the business volume the cooperative needs to capture economies of scale in marketing and logistics, and provide competitive pressure within the market place. And second, it provides the equity capital the cooperative needs to finance business operations.

Fourth, there are no long term marketing contracts required for membership. Thus, an individual is free to market as many, or as few, animals through the cooperative at any time they choose. UPI does offer to arrange short term or long term marketing contracts with livestock buyers or processors as a service to their members. However, UPI only acts as an agent to arrange the contracts and the contracts are not required for membership.

Fifth, UPI has a centralized, rather than federated, organizational structure where the individual is a direct member of the cooperative. Some large, multi-state cooperatives have adopted a federated organizational structure. A centralized structure is preferred because Olson (1965) suggested free riding behavior could be mitigated by using a federated structure. Thus, free riding should be more prevalent within a centralized organization.

[11] The per unit capital retain is $0.75 per head of cattle, $0.25 per head of swine, sheep or goats and $0.50 per head for other livestock species.

And finally, UPI's leadership supports the research objectives and believes the results will create value of the cooperative, as well as other producer owned organizations. Given the above criteria, United Producers Inc. provides an organizational structure and economic environment that is favorable for studying all three potential dimensions the free rider problem; consumption based, production based and interaction based free riding. It also allows the analysis to focus on the actions of the individual member, or decision maker, rather than comparing composite group actions across multiple groups.

UPI Membership Survey

A stratified random sample of UPI members received a mail survey in July of 2006. Four segments of the membership were identified and surveyed; they were 1) voting members with patronage exceeding the mean patronage level, 2) voting members with patronage less than the mean patronage level, 3) non-voting members and 4) district delegates. The mean patronage level was calculated for all voting members based upon the number of head sold during the 2005 fiscal year[12]. The number of hogs, sheep and goats sold were converted to *cattle head equivalents*[13] before the mean patronage level was calculated by UPI's senior management. There were 2178 voting members with patronage exceeding the mean patronage level of 70.3 head per year and 9370 voting members with patronage less than the mean patronage level.

The names of the current 223 district delegates were removed from the list of voting members and the remaining 11,325 members were resorted by cattle head equivalents. The 2000 members with the largest volume of head equivalents were classified as *large voting members*.

[12] UPI's fiscal year is from January 1 through December 31.

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

2000 names were randomly selected from the remaining 9,325 voting members and classified as *small voting members*. 1500 names were randomly selected from the 39,875 non-voting members and classified as *non-voting members.*

After careful review, it was determined that 178 addresses were incomplete and undeliverable by the postal service. A total of 5545 surveys were mailed to UPI members; 1963 to large voting members, 1908 to small voting members, 1451 to non-voting members and all 223 district delegates. A total of 575 surveys were returned, which represents approximately 10.4 percent of the total surveys mailed. There were 199 surveys returned from the large voting member classification, 217 returned from the small voting member classification, 99 from the non-voting member classification and 60 from the district delegate classification. Table 1 summarizes the survey response rate information by membership class.

Table 1: United Producers Inc. Survey Response Rate by Membership Class.

Membership Class	Total Number of Members Within Class	Number of Surveys Mailed	Number of Surveys Returned	Percent Response Rate	
				Percent of Total Members Within Class	Percent of Surveys Mailed
Voting members with patronage above the mean.	2,000	1,963	199	9.95 %	10.14 %
Voting members with patronage below the mean.	9,325	1908	217	2.33 %	11.37 %
Non-Voting Members	39,875	1,451	99	0.25%	6.82 %
District Delegates	223	223	60	26.90 %	26.90 %
Total	51,423	5,545	575	1.12 %	10.37 %

Free Riding CFA Model Results

The data from the UPI member survey was used as input to test the conceptual CFA model presented in Figure 1. **It should be emphasized that these are preliminary findings and that expanded descriptive and inferential analysis is being conducted to validate the results.**

The manifest variable *Percent Head Sold to Cooperative* was dropped from the analysis due to the high level of missing observations. Approximately 43% of the surveys contained enough information to calculate the values needed for this variable. It was also noted during the data entry process that there was a strong tendency for individuals who did not provide sales information to be classified as free riders based upon their responses to other survey questions. This observed tendency does not conform to the *missing at random* assumption needed for the full information maximum likelihood estimation procedure used within AMOS 6.0 to handle missing data (Arbuckle, 2005 and Wiggings and Sacker, 2002).

The remaining variables were included in the CFA model and analyzed using AMOS 6.0. The standardized factor loadings, estimated standard errors, critical values and *P* values for the model are presented in Table 2.

Standardized estimates are presented to facilitate a direct comparison of factor loadings across manifest variables and interpret the relative sensitivity of each variable. The standardized factor loadings are analogous to standardized regression weights in an Ordinary Least Squares regression analysis. Once again, the latent free riding variable is the exogenous variable which has a direct effect on the endogenous manifest variables. Therefore, a one standard deviation increase in the scaling of the latent free riding variable will result in a 0.644 standard deviation

increase in the value of the *Read UPI Information* variable. Thus, the larger the value of the standardized factor loading (γ_1 to γ_7) the more sensitive the manifest variable is to changes in the underlying latent variable.

Table 2: Standardized Factor Loadings, Estimated Standard Errors, Critical Values and *P* Values for the Free Riding Confirmatory Factor Analysis Model.

Manifest Variable	Standardized Factor Loading	Estimated Standard Error	χ^2 Critical Value[1]	*P* Value
Strong Supporter of UPI	$\gamma_1 = 0.584$	0.041	12.065	***
Consistent Patron of UPI	$\gamma_2 = 0.359$	0.042	6.987	***
"Best Deal" Member	$\gamma_3 = -0.169$	0.054	-3.345	***
Read UPI Information	$\gamma_4 = 0.644$	0.043	13.089	***
Discuss Cooperative with Neighbor.	$\gamma_5 = 0.631$	0.054	12.635	***
Actively Monitor Management	$\gamma_6 = 0.543$	0.057	10.576	***
Do Not Contact UPI About Concerns	$\gamma_7 = -0.400$	0.023	-7.789	***
Percent Head Sold to UPI	γ_8 = Dropped due to excessive missing data			

*** Indicates a *P* value of less than 0.001 (two-tailed)
1 – This model has a sample size of 575, with 12 degrees of freedom

It is important to note that the free riding latent variable is assumed to be continuous and does not have assigned units[14]. The scaling of the latent variable is influenced by the scaling of the associated manifest variables. **For this model, a low value for the free riding latent variable indicates a high level of free riding behavior.** Therefore, the -0.169 coefficient on the

[14] In order for estimates to be calculated within a latent variable analysis, the model must be mathematically identified. Mathematical identification requires either 1) the variance of the latent variable be set equal to one, which allows for a factor loading to be estimated for each manifest variable, or 2) the factor loading for one of the manifest variables be set equal to one, which allows the variance of the latent variable to be estimated. For this model, the first option was chosen and the variance of the latent variable is assumed to be one.

"Best Deal" Member variable indicates a negative relationship between the scaling of the latent and manifest variables (i.e. a high value on the *"Best Deal" Member* variable indicates a higher level of free riding behavior).

Overall Model Fit

One of the weaknesses of CFA models, and latent variable analysis in general, is the lack of a single accepted measure of overall model fit. Therefore, a set of fit indices is recommended to build consensus concerning model fit. Table 3 presents the estimated values and recommended values for selected fit indices.

Table 3: Selected Model Fit Indices

Fit Index	Estimated Model Value	Recommended Value
Chi-Square	39.417[1]	Value heavily influenced by sample size. No general recommendation
Normed Fit Index (NFI)	0.946	0.90 or greater = good fit
Comparative Fit Index (CFI)	0.961	0.90 or grater = good fit
Root-Mean-Square Error of Approximation (RMSEA)	0.063[2]	0.05 or less = close fit 0.05 ≤ value ≤ 0.08 = good fit Value ≥ 0.10 poor fit
Tucker-Lewis Index (TLI)	0.909	0.95 or greater = superior fit

1- This model has 12 degrees of freedom with a sample size of 575
2 – 90 % confidence interval = 0.042 to 0.086

Based upon the set of model fit indices, this model has a good overall fit. The Normed Fit Index (NFI = 0.946) and the Comparative Fit Index (CRI = 0.961) are both above the recommended values (0.90 for each) and the Root-Mean-Square Error of Approximation (RMSEA = 0.063) is below the recommended value (0.08) for good overall model fit. Although the Tucker-Lewis Index (TLI = 0.909) is not above the recommended value (0.95) for superior fit, it does indicate good overall fit.

There were three modifications made to the original model presented in Figure 1. First, as mentioned above, the *Percent Head Sold to Cooperative* variable was dropped from the analysis due to missing data problems. Second, a correlation between the error term of the *Strong Supporter* variable (ε_1) and the error term of the *Consistent Patron* variable (ε_2) was added. And third, a correlation between the error term of the *Discuss With Neighbor* variable (ε_5) and the error term of the *Monitor Management* variable (ε_6) was also added.

The addition of the two error term correlations was based upon observed correlations reported within the analysis output section of the base model[15]. The model fitted correlation between ε_1 and ε_2 was 0.409 and the model fitted correlation between ε_5 and ε_6 was 0.325. Both of these values were statistically significant at the 0.01 level and improved overall model fit.

Conclusions

The objective of this study is to develop an analytic approach to more accurately capture the multiple dimensions of free riding within collective action organizations. A CFA model is used to test for the relative importance and statistical significance of alternative member free riding measures. A member survey of a large agricultural cooperative is used as the data source.

The preliminary findings suggest there is no single dominant indicator for member free riding, but rather a set of indicators that are relevant. Regular participation in communication activities is shown to be the most sensitive indicator of free riding. Both communication between the member and cooperative, as well as communication between peers ($\gamma_4 = 0.644$ and $\gamma_5 = 0.631$ respectively) are important indicators. This suggests that the organization may be

[15] Modification Indices were not available for this model because AMOS 6.0 cannot calculate modification indices when a mean structure has been included in the model.

able to reduce member free riding by promoting an environment or format which allows members to regularly meet and discuss the organization's activities and their participation within the group.

The significance of the dummy variable for contacting the cooperative with concerns about operations ($\gamma_7 = -0.400$), a proxy for communicating preferences, suggests that easy access to key decision makers within the organization may also be important. Easy access to decision makers might influence the ability of the member to actively monitor management activities, which is also a relatively sensitive indicator of free riding ($\gamma_6 = 0.543$).

The self assessment variables of general support for the cooperative ($\gamma_1 = 0.584$) and consistent patronage ($\gamma_2 = 0.359$) were also sensitive indicators. This suggests that individual members have a general sense for how they rank relative to other members regarding their effort in creating collective benefits.

While the *"Best Deal" Member*, measuring how sensitive patronage levels were to competitor's pricing, was the least sensitive ($\gamma_3 = -0.169$) but still statistically significant. This suggests that, while relative prices do influence the patronage decision, price is not the only factor influencing patronage.

Establishing a more accurate measure of the multiple dimensions of member free riding is a first step in testing the effectiveness of alternative methods for measuring the free rider problem. Although the findings are preliminary, this study moves us in the direction of achieving that larger goal.

References

Alchian, Arman A. and Harold Demsetz (1972), "Production, Information Costs, and Economic Organization", *The American Economic Review* Vol.62, No. 5: 777-795

Arbuckle, James L. (2005), *Amos 6.0 Users Guide*, Springhouse, PA: Amos Development Corporation.

Axelrod, Robert (1984), *The Evolution of Cooperation*. New York, NY: Basic Books

Cook, Michael L. (1995), "The Future of U.S. Agricultural Cooperatives: A Neo-Institutional Approach", *American Journal of Agricultural Economics* Vol. 77, No. 5:1153-1159

Cook, Michael L. and Fabio R. Chaddad (2004), "Redesigning Cooperative Boundaries: The Emergence of New Models", *American Journal of Agricultural Economics* Vol. 86, No. 5: 1249-1253

Cook, Michael L and Constantine Iliopoulos (2000), "Ill-Defined Property Rights in Collective Action: The Case of U.S. Agricultural Cooperatives", in *Institutions, Contracts and Organizations*, Claude Menard (ed.), pp. 335-348, Cheltenham, UK: Edward Elgar

Fairbairn, Brett (2004), "History of Cooperatives", in *Cooperatives and Local Development*, Christopher D. Merritt and Norman Walzer (eds.), pp. 23-51, Armonk, NY: M.E. Sharpe

Hansmann, Henry (1996), *The Ownership of Enterprise*, Cambridge, MA: Belknap Press of Harvard University Press.

Heckathorn, Douglas D. (1996), "The Dynamics and Dilemmas of Collective Action", *American Sociological Review*, Vol. 61, No. 2: 250-277

Ingalsbe, Gene and Frank Groves (1989), "Historical Development", in *Cooperatives in Agriculture*, David Cobia (ed.), pp. 106-120, Englewood Cliffs, CA: Prentice Hall

Jensen, Michael C and William H. Meckling (1976), "The Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure", *Journal of Financial Economics*, Vol. 3, No. 4: 305-360

Kline, Rex B. (2005), *Principles and Practice of Structural Equation Modeling*, 2nd Ed., New York, NY: Guilford Press

Loehlin, John C (2003), *Latent Variable Models*, Mahwah, NJ: Lawrence Erlbaum Assoc.

McMillan, John (1979), "The Free-Rider Problem: A Survey", *The Economic Record* 55 (149):95-107

Megginson, William L. (1996), *Corporate Finance Theory*, Reading, MA: Addison-Wesley

Mueller, Ralph O. (1996), *Basic Principles of Structural Equation Modeling*, New York, NY: Springer.

Nourse, E.G. (1922), "The Economic Philosophy of Co-operation", *The American Economic Review*, Vol. 12, No. 4:577-597

Olson, Mancur (1965), *The Logic of Collective Action: Public Goods and the Theory of Groups,* Cambridge, MA: Harvard University Press

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

Ostrom, Elinor, Roy Gardner, and James Walker (1994), *Rules, Games, and Common-Pool Resources*, Ann Arbor, MI: University of Michigan Press

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

Pedhazure, Elazar J. (1997), *Multiple Regression in Behavioral Research*, London, UK: Wadsworth.

Sandler, Todd (1992), *Collective Action*, Ann Arbor, MI, University of Michigan Press.

Sapiro, Aaron (1993), "True Farmer Cooperation", *Journal of Agricultural Cooperation*, Vol. 8: 81-93

U.S. Department of Agriculture (2006), *Agricultural Prices*, Washington, DC: USDA-NASS, Jan. 31, 2006

Wansbeek, Tom and Erik Meijer (2000), *Measuring Error and Latent Variables in Econometrics*, Oxford, UK: Elsevier

Wiggins, Richard D. and Amanda Sacker (2002), in *Latent Variable and Latent Structure Models*, George A. Marcoulides and Irini Moustaki (eds). pp.105-120, Mahwah, NJ: Lawrence Erlbaum Assoc.