Towards a Measurement of Free Riding within Private Collective Action Organizations

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Towards a Measurement of Free Riding within Private Collective Action Organizations

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Abstract. *The objective of this study is to determine if there is a dominant free riding activity which can be identified and used as the basis for measuring free riding, or if multiple free riding actions and/or behaviors coexist within large collective action organizations. The study uses a confirmatory factor analysis model to evaluate member level survey data from a large agricultural marketing cooperative.*

Introduction:

Collective action and organization scholars have conceptually addressed the free rider problem for fifty years, but little empirical work informs this complex and prevalent problem. This study's objective is to determine if there is a dominant free riding activity which can be identified and used as the basis for measuring free riding, or if multiple free riding actions and/or behaviors coexist within large collective action organizations. Olson (1965) defines a collective good "as any good such that, if any person X_i, in a group $X_1,\ldots,X_i,\ldots,X_,$ consumes it, it cannot feasibly be withheld from others in that group." Thus, all group members could access the collective benefits, or consume the good, even if they did not contribute towards its provision.[2] As a result, access to collective benefits alone may not provide a strong enough direct incentive for individuals to contribute towards group action.

Olson describes three general classes of collective action groups; privileged, latent and intermediate. A *privileged group* has the greatest likelihood for creating collective benefits. This group contains at least one individual who receives a large enough portion of total group

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[2] Olson followed Musgrave's (1959) distinction between public and private goods by focusing on the inability to exclude benefits as the distinguishing characteristic. Including Samuelson's (1954) *jointness of consumption* distinction would delineate a pure public good, but was not a necessary component of Olson's propositions.

benefits to be willing to bear all of the costs for providing the collective good, if necessary. Privileged groups tend to be small for three reasons. First, each individual within a small group receives a greater portion of the total group benefit relative to those within a large group increasing the likelihood that at least one individual would be willing to bear all of the provision costs. Second, it is less expensive to coordinate the activities of a small group. Small groups may be able to achieve their objectives without creating a formal organization; but if a formal organization is required, the formation and maintenance costs for a small group would be less than a large group. And third, it is easier for members in a small group to monitor the actions of other members and detect changes in contribution levels. This allows the group to use social incentives to reward collaboration or punish non-collaboration.

In contrast, *latent groups* are groups that are unable to form and/or sustain the provision of collective benefits. They face the diametric opposite conditions found within privileged groups and tend to be large.[3] Individuals within a latent group receive a very small portion of the total group benefits, which produce little direct incentive for an individual to contribute resources towards group activities. In addition, large groups typically need formal organizations to coordinate activities and supply collective goods, increasing the cost of formation and provision. And finally, a large size makes it difficult for group members to detect and/or identify individuals who do not contribute or quit contributing towards group activities.

The third class of groups is *intermediate groups*. Intermediate groups contain no individual members who receive a large enough portion of the total group benefit to be willing to bear all of the provision costs but it was possible for members to detect if an individual, or a sub-group of individuals, alters their contributions. Thus, group coordination is required to supply

[3] Olson did not provide any numerical definition of large groups or small groups, only a description of their characteristics.

the collective good, but one could not *a priori* determine if the group would have the ability to create collective benefits.

These group delineations lead to the recognition that it is rational for some groups to lack the ability to voluntarily provide themselves with collective goods, even though there is the potential to create substantial common group benefits. The key element which produces this condition is the inability to fully exclude benefits.

Consequently, a core challenge for latent groups is to mobilize group members and generate a basic level of collective benefits. For privileged and functioning intermediate groups, a core challenge is to entice group members to bear their proportional share of the costs for supplying the desired collective goods and enhance the total level of benefits provided. This study considers challenges confronting intermediate collective action groups; more specifically, large private collective action organizations that are attempting to enhance the provision of difficult to exclude benefits for its members.

Olson's basic tenet is that non-excludable benefits create weak direct incentives for self interested individuals to act in a group's collective best interest, even though the group members share a common objective and can gain from group action. Ostrom (2003) argues that Olson's goal of building a general theory of collective action is overly ambitious and that a family of theories is required. Ostrom agrees that the inability to fully exclude benefits is important but suggests that combining the non-excludability attribute highlighted by Musgrave (1959) with Samuelson's (1954) emphasis on jointness of consumption, or non-rivalry in consumption, provides significant insights and is an important refinement.[4] This combined viewpoint provides

[4] This distinction can also be found in Ostrom and Ostrom (1977) and Ostrom, Gardner and Walker (1994). Head (1962) also discussed the value of including both non-excludability and jointness of consumption in describing pure public goods, but did not attempt to create a classification structure.

a general distinction between pure public goods, common pool resources, toll or club goods and private goods.[5]

Ostrom argues that the difficulty with excluding benefits "is the defining attribute of collective action problems", but that the subtractability of collective benefits is also significant because it too influences an actor's behavior. This becomes apparent when one considers adding more members to a group. In a common pool resource setting, the group is attempting to limit membership and reduce excess appropriation of a shared resource, with the goal of avoiding the *tragedy of the commons*. In contrast, within a pure public goods setting, the group is attempting to enhance membership to reduce per member costs and/or increase the provision of collective benefits.[6] Thus, the group coordination activities required for subtractable collective goods are different than the group coordination activities for non-subtractable collective goods, and Ostrom contends that a general theory which explains behavior in both groups is not possible. This study concentrates on organizations attempting to provide difficult to exclude benefits that have limited or no consumption rivalry.

The concept of free riding is typically associated with challenges confronting collective action and provision of public goods, but is also applied to similar challenges within team production settings. Additionally, many private collective action organizations face team production – free riding issues.

There appear to be two key conditions which allow individuals to free ride within private collective action organizations. The first is the inability to fully exclude benefits from those who do not collaborate, or exclusion based free riding. The second is the inability to

[5] Pure public goods are both non-excludable and non-rivalrous in consumption. Common pool resources are difficult or impossible to exclude, but do exhibit consumption rivalry. Club or toll goods are excludable, but have limited or no consumption rivalry. Private goods are fully excludable and rivalrous in consumption.
[6] Olson made a similar argument when discussing the difference between *inclusive* and *exclusive* groups.

accurately determine an individual's contributions towards group action, or measurement based free riding.[7] These collective action organizations may confront varying degrees of both exclusion and measurement based free riding.

The term free riding is broadly defined and generally refers to an individual who benefits from group actions without bearing their proportional or appropriate share of the group costs. However, there are a variety of individual actions or behaviors that have been used as examples of free riding. In cases where exclusion of benefits is the primary focus, free riding is often described as failing to contribute appropriate financial resources towards group action, failing to fully reveal preferences for group benefits, or over appropriating shared resources. For cases where measuring individual contributions is difficult, free riding is generally described as withholding effort or human capital and failing to perform monitoring functions.

Findings from game theory and game experiments suggest there may be additional interaction based free riding activities. These include individual actions or behaviors that have been shown to improve or enhance group coordination, such as repeated interaction, communication activities or participation in sanctioning activities.[8] Thus, failing to take part in these activities could be viewed as an alternative form of free riding.

The Study Objective and Method:

Measuring free riding in large groups is difficult and complex due to a combination of factors; the broad definition given to the concept of free riding, the wide range of activities that

[7] An organization may have difficulty identifying which individuals are contributing to group action and/or determining the contribution level for a specific individual.

[8] In many situations, the monitoring and sanctioning functions are bundled together and jointly assigned to an identified individual or sub-group. However, this is not always the case. Ostrom, Gardner and Walker (1994) discuss research case study findings of common pool resource settings where one sub-group is responsible for monitoring appropriation and another sub-group has authority to sanction violators.

have been used to describe free riding, and the latent nature of most free riding actions. Developing an accurate measure of free riding is a research and application challenge. The lack of a broadly accepted measure for free riding has also made it difficult to empirically test the effectiveness of alternative strategies proposed to mitigate the free rider problem, especially the effectiveness of alternative selective incentives.

This study's has two general objectives: a) to determine if there is a dominant free riding activity which can be identified and used as the basis for measuring free riding, and b) to determine whether multiple free riding actions and/or behaviors coexist within large collective action organizations. This requires that alternative free riding activities be specified and a method be developed to test for the presence of multiple free riding activities. The results of our study will influence the methods used to measure free riding and the ability to test alternative approaches used to mitigate free riding.

Our general hypothesis is quite simple: multiple types of free riding behavior coexist in large collective action organizations. A confirmatory factor analysis model is used to evaluate member level survey data from a large agricultural livestock marketing cooperative.

Agricultural Cooperatives as a form of Collective Action - Agricultural cooperatives have been used as examples of successful collective action efforts (Olson [1965], Staatz [1987], Hansmann [1996], Holmstrom [1999]) for over 150 years in the United States. During this time, millions of farmers and ranchers have utilized a wide variety of formal and informal bargaining associations and cooperative business structures to create and maintain collective goods. Although cooperative business collective good objectives are multiple, one mentioned frequently in the literature is to function as a *competitive yardstick* (Nourse [1922], LeVay [1983], Sexton [1986], Staatz [1987]). The objective of this joint goal is to improve the terms of trade for

members and/or ensure competitive local markets for farm output and/or production inputs. More competitive local markets is one example of collective benefits with public goods attributes; they are non-rivalrous in consumption, difficult to exclude and the benefits accrue directly to the individual, rather than being accumulated at the organizational level and re-distributed to members. Many agricultural cooperatives also maintain a voluntary open membership policy with minimal barriers to entry or exit. Thus, individuals have the discretion to choose varying patronage levels over time, ranging from zero patronage to all purchases and/or sales made through the cooperative. When member patronage generates residuals these are returned to patrons and act as an economic tool for keeping the rival(s) "honest", in other words, diminishing the probability of monopolistic or monopsonist rents being extracted from the market.

The public goods nature of more competitive local markets combined with the voluntary open membership policies of most cooperative business structures makes the free rider problem a significant issue for many cooperatives (Staatz, 1987 and Cook, 1995). As local markets become more competitive, there is less incentive for individuals to patronize the cooperative. If a significant portion of the cooperative's patrons switch their transactions to competing firms, the commercial viability of the cooperative becomes tenuous. We choose a cooperative with a large membership to explore our general hypothesis.

United Producers Inc. (UPI) is a livestock marketing cooperative headquartered in Columbus, Ohio and formed in 1933 to "provide livestock producers access to competitive markets". This *competitive yardstick* objective remains the central theme of their current mission statement[9]. UPI operates local auction facilities and animal collection points for five livestock

[9] Personal discussion with Dennis Bolling, President & CEO of United Producers Inc.

species in six states[10]. There were 51, 423 individual farmers or farm entities listed as patron-members in 2005. The membership base consists of a wide variety of producers and production systems, ranging from large commercial operations to small hobby farms. UPI meets our study design criteria: it was formed to create collective benefits that have public good attributes (i.e. more competitive local markets which are non-rivalrous and difficult to exclude), has a voluntary open membership policy with low barriers to entry and exit,[11] has a large and diverse membership base and indicated support for the research effort.

The Model - Figure 1 is a path diagram of the confirmatory factor analysis model used to test the hypothesis. Eight manifest indicator variables are developed from previous empirical and theoretical collective action related free riding studies. This model assumes a single latent variable, labeled *Member Free Riding*, which has a direct effect on the eight manifest indicator variables.

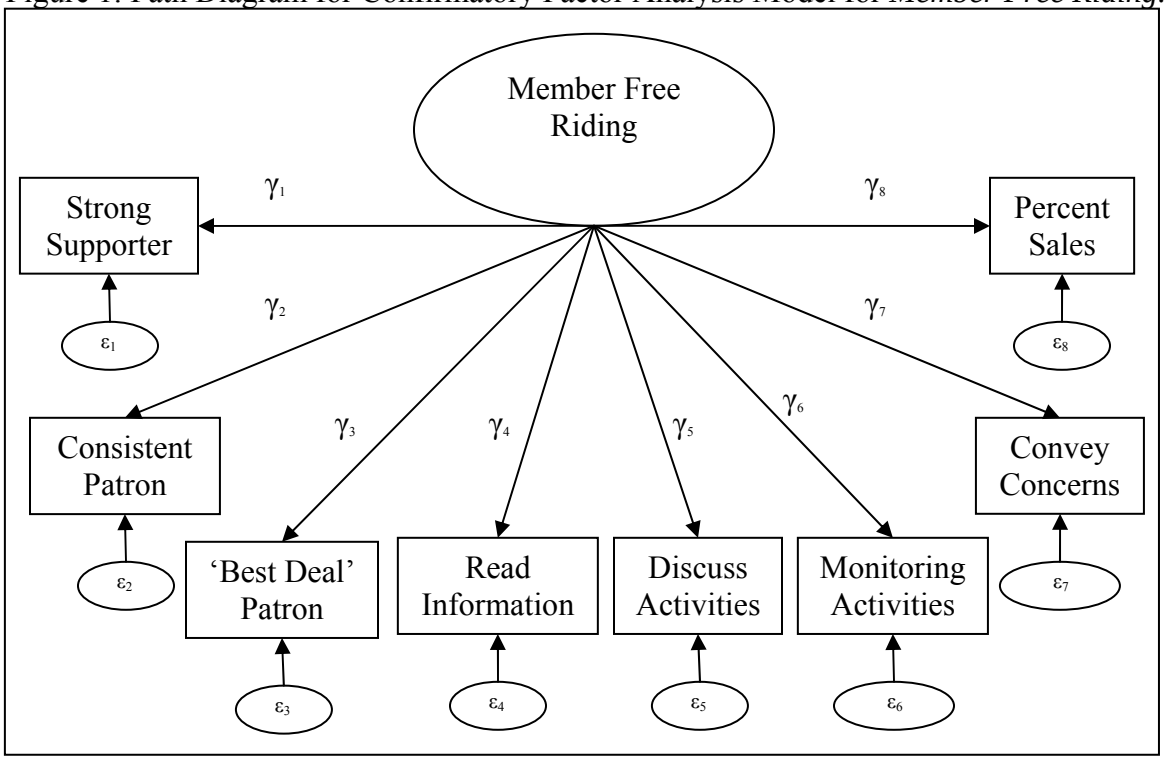
The first six indicator variables, moving from left to right in Figure 1, are Likert scale responses to statements regarding various member activities. The first variable, labeled *Strong Supporter,* is a self assessment question asking if the member considered themselves a strong supporter of the cooperative. The second indicator variable, *Consistent Patron*, corresponds to the level of member patronage consistency during the past five years. The third variable, *'Best Deal' Patron*, identifies the price or cost of the transaction sensitivity. The fourth indicator variable, *Read Information*, measures the interface of written communication from the cooperative. Indicator variable five, *Discuss Activities*, explores the degree of cross patron

[10] United Producers Inc. markets beef cattle, dairy cattle, hogs, sheep and goats in Ohio, Illinois, Indiana, Missouri, Michigan and Kentucky.

[11] To become a member of UPI, a farmer or farm unit must market livestock through one of the auction facilities or collection points. To obtain voting privileges to elect district delegates, a UPI member must market at least 20 animals per calendar year through the cooperative. To become a preferred voting member, and access additional member benefits, an individual must market at least 20 animals per calendar year through the cooperative and agree to have a $20.00 annual fee withheld from their first sales check each year. There were 39,875 non-voting members and 11,548 voting preferred members of UPI in 2005

engagement. Variable six, *Monitoring Activities*, measures the monitoring intensity of the patron member.

Figure 1: Path Diagram for Confirmatory Factor Analysis Model for *Member Free Riding.*



The seventh indicator variable, *Convey Concerns,* measures the degree of member internal networking for monitoring objectives. The survey listed five alternative contacts and a sixth choice to do nothing. These choices were rank ordered and assigned a value based upon the level of decision making authority and control the respective contact had over the cooperative's operations and policies.[12] The final indicator variable, *Percent Sales*, measures percent of total member production marketed through the cooperative during the 2005 calendar year.

[12] 'Do Nothing' was as assigned a value of 1, contact an employee a value of 2, contact a local site manager or senior manager a value of 3, contact a district delegate or member of the board of directors a value of 4 and make multiple contacts a value of 5.

The Data - A stratified random sample of UPI members was surveyed in July of 2006. Four membership segments were surveyed; 1) preferred voting members with patronage exceeding the mean patronage level, 2) preferred voting members with patronage less than the mean patronage level, 3) non-voting members and 4) district delegates.[13] The stratification process was done to provide a representative sample of the cooperative's membership based upon member business volume and decision making authority rather than a random sample across all members.[14] A total of 5545 surveys were mailed to UPI members, with 575 surveys returned. This represents approximately 10.4 percent overall response rate.[15]

Initial Analysis - An analysis of the responses for individual survey questions show that 55.3 percent (318 of the 575 returned surveys) of the values required for calculating the Percent Sales manifest variable were missing, and that 134 of the 257 available calculated values (52.1 percent) were reported as 100 percent. The combination of a high percentage of missing values and a large portion of the valid responses reported as 100 percent raised serious concerns about response bias. As a result, the Percent Sales variable was dropped from the analysis.

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[13] See footnote 32 for a discussion of the differences between voting preferred and non-voting members. The 2005 individual sales volume, in head of livestock, for each voting member who was not a district delegate was converted to a *cattle head equivalent* using a ratio of 7:1 for hogs to cattle equivalents and 17:1 ratio for sheep and goats to cattle equivalents. The mean value for all cattle equivalent sales, of 70.3 head, was then calculated. Voting members with sales volume above 70 head of cattle equivalents were placed in the above average patronage sub-group, while voting members with sales of less than 70 head of cattle equivalents were placed in the below average patronage sub-group. The 223 District delegates are preferred voting members who have been elected to represent a specific geographic region and are responsible for electing the cooperative's board of directors, approving all changes to the cooperative's by-laws and merging or dissolving the organization.

[14] Approximately 38 percent of UPI's 2005 business volume came from the 2,178 members in the above average patronage voting member sub-group, approximately 38 percent from the 9,370 voting members in the below average patronage voting member sub-group and approximately 24 percent from the 39,875 non-voting members.

[15]There were 1963 surveys sent to voting members in the above average patronage sub-group, 1908 to voting members in the below average patronage sub-group, 1451 to non-voting members and all 223 district delegates. There were 199 (10.1%) surveys returned from the high patronage voting member classification, 217 (11.3%) from the low patronage voting member classification, 99 (6.8%) from the non-voting member classification and 60 (26.9%) from the district delegate classification.

The modified model[16] from Figure 1 was analyzed using data from the raw score matrix in Amos 6.0.[17] Results in Table 1 report the un-standardized and standardized factor loadings, estimated standard errors, critical ratio, *P* value and squared multiple correlation for each manifest indicator variable. Table 2 reports selected model fit statistics.

Table 1: Un-standardized Factor Loadings, Standardized Factor Loadings, Estimated Standard Errors, Critical Ratios, *P* Values and Squared Multiple Correlations for the *Member Free Riding* Confirmatory Factor Analysis Model.

Manifest Variable	Un-standardized Factor Loadings	Standardized Factor Loading	Estimated Standard Error	*z* Critical Ratio[1]	*P* Value	Squared Multiple Correlation
Strong Supporter	0.496	0.590	0.041	12.110	***	0.348
Consistent Patron	0.302	0.373	0.042	7.235	***	0.139
'Best Deal' Patron	-0.191	-0.181	0.054	- 3.562	***	0.033
Read Information	0.550	0.623	0.043	12.646	***	0.388
Discuss Activities	0.693	0.637	0.055	12.637	***	0.406
Monitoring Activities	0.611	0.551	0.057	10.646	***	0.304
Convey Concerns	0.559	0.382	0.076	7.329	***	0.146

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

[16] Two additional modifications were made to the initial model presented in Figure 1 during the estimation process. First, a correlation was added between the error terms of the Strong Supporter and Consistent Patron manifest variables (ε_1 and ε_2). Adding this was warranted because they are both self assessment indicators and it is reasonable to assume that these variables share some level of common measurement error. The second modification was to add a correlation between the error terms of the Discuss Activities and Monitoring Activities variables (ε_5 and ε_6). This can be justified on the basis that a portion of the discussions between neighbors would be related to the actions and performance of the cooperative's management and employees. The estimated correlation between the error terms of the Strong Supporter and Consistent Patron variables was 0.203, while the estimated correlation between the error terms of Discuss Activities and Monitoring Activities was 0.244.

[17] Amos 6.0 utilizes the Full Information Maximum Likelihood (FIML) data imputation method to fill in missing data observations, rather than listwise deletion, pairwise deletion or mean replacement. As long as the *missing at random* assumption holds for the missing observations, Amos will provide both efficient and consistent parameter estimates (Wiggings and Sacker, 2002 and Arbuckle, 2005). This imputation process also requires that a mean structure be added to the model.

Table 2: Selected Model Fit Indices for the *Member Free Riding* Confirmatory Factor Analysis Model.

Model Fit Index	Estimated Value
χ^2_m	48.454[1]
Root-Mean-Square Error of Approximation (RMSEA)	0.073[2]
Akaike Information Criterion (AIC)	94.454
Normed Fit Index (NFI)	0.934
Comparative Fit Index (CFI)	0.948
Tucker-Lewis Index (TLI)	0.880

1 This model has 12 degrees of freedom. The *p* value was less than 0.001 so H_o is not rejected.
2 90 % confidence interval = 0.052 to 0.095

Each of the individual factor loadings were statistically significant and had the correct anticipated sign[18]. A review of the standardized factor loadings indicates that there is no single dominant indicator for the latent free riding variable, but rather a variety of member actions that contribute information towards describing free riding.[19] The Discuss Activities, Read Information, Strong Supporter and Monitoring Activities variables had the highest standardized factor loadings of 0.673, 0.623, 0.590 and 0.551, respectively. While the Convey Concerns, Consistent Patron, and 'Best Deal' Patron variables had lower standardized factor loadings of 0.382, 0.373 and -0.181, respectively.

The selected model fit indices suggest a good overall model fit for the single latent construct and that the implied variance – covariance structure of the model does a good job of explaining the variation and co-variation of the manifest variables in the data set. This indicates a tendency for manifest variables to move together implying individuals who free ride in one activity have a tendency to free ride in other activities.

[18] The negative sign on the 'Best Deal' Patron variable is due to the phrasing and scaling used for the survey questions. All of the other questions used a high response value to indicate low free riding activities and/or behaviors. However, the 'Best Deal' Patron variable used a low value to indicate a low level of free riding.
[19] Standardized factor loadings are analogous to standardized regression weights in linear regression. A larger standardized factor loading suggests that the manifest variable is a more sensitive indicator for the latent variable.

The lack of a single dominant indicator suggests that free riding in large private collective action organizations may be more complex than first believed, and that focusing efforts on one indicator or proxy may not fully capture all of the key attributes of member free riding behavior. However, differences in the standardized factor loadings suggest that some manifest variables may be more sensitive indicators than other manifest variables.

Additional Analysis - Because of membership sub-group stratifications based on business volume and voting rights, it is possible to test for differences in the mean level of free riding activities across sub-groups within the same organization. This was accomplished by performing a multi-group confirmatory factor analysis.

The base model presented above was re-run setting the factor loading and intercept term for the Discuss Activities indicator variable equal to a value of one[20]. This allowed the mean and variance values for the latent *Member Free Riding* variable to be estimated. The estimated mean free riding value using the full data set was 2.040 and the estimated variance was 0.480.[21]

The data set was then divided based upon the respective survey sub-groups and assigned to a unique group within a multi-group confirmatory factor analysis model. A series of nested multi-group models were tested to determine if the estimated manifest variable factor loadings and latent variable mean values were statistically different.[22] Appendix Table 1 reports the un-standardized and standardized factor loadings for all indicator variables for each member sub-

[20] The Discuss Activities indicator variable was chosen as the reference variable because it had the highest estimated standardized factor loading and the largest squared multiple correlation.

[21] Assigning the Discuss Activities manifest variable as a reference variable allows a mean and variance to be estimated for the *Member Free Riding* latent variable. Thus, the latent variable takes on the scaling of the indicator variable, which was a Likert Scale ranging from one to five. This procedure did not alter any of the standardized factor loadings or overall model fit statistics.

[22] The Discuss Activities manifest variable was consistently used as the reference variable. In the initial multi-group analysis, all free factor loadings were unconstrained and each nested model introduced additional constraints. Estimated factor loadings that were not statistically significant at the $\alpha = 0.10$ level were set equal to zero, un-standardized factor loadings for each manifest variable were tested across groups for equivalence and the estimated mean for each sub-group latent variable was tested for equivalence.

group, as well as the original base model which used the full data set. Appendix Table 2 reports selected overall model fit statistics for the multi-group model and the original base model.

All of the non-zero individual factor loadings were statistically significant[23] and the model fit indices showed good overall model fit. The estimated mean values for the latent free riding variables were not statistically different for the Above Average Patronage Voting Member and Below Average Patronage Voting Member sub-groups, with an estimated value of 2.019. However, the estimated latent variable variance was lower for the Below Average Patronage Voting Member sub-group, at 0.239, than the estimated variance for the Above Average Patronage Voting Member sub-group, which was 0.877. The estimated latent variable mean value for the Non-Voting Member sub-group was lowest, with a value of 1.732, and an estimated variance of 1.186. The District Delegate sub-group had the highest estimates latent variable mean value of 2.716, and an estimated variance of 0.480.

The Discuss Activities manifest variable was used as the reference variable in the multi-group analysis, so the free riding latent variable takes on the one to five Likert scaling of this variable. Thus, a *higher* mean value for the latent variable indicates a *lower* level of free riding activities. As a result, the District Delegate sub-group had the lowest mean level of free riding (2.716), with the Voting Members, both above and below average patronage, having a higher mean level of free riding (2.019) and the Non-Voting Members showing the highest mean free riding level (1.732).

This finding suggests that there are differences in the mean level of free riding activities across member sub-groups within the same organization. Indications are that historical patronage levels and access to decision rights within the organization may play a role in free

[23] All of the non-zero individual factor loadings were significant at the $\alpha = 0.05$ level except for the 'Best Deal' Patron variable in the District Delegate sub-group, which had an estimated *p* value of 0.079.

riding, due to the criteria used to define the sub-groups. However, there is not enough evidence to make definitive statements on whether historical patronage can be used as an indicator variable for free riding, due to missing data problems, or whether access to control rights, via voting privileges, has an influence on free riding actions and/or behaviors.

The multi-group analysis showed differences in the estimated factor loadings for the same manifest indicator variables across member sub-groups suggesting sensitivity of alternative indicator variables may also vary across member sub-groups. There were 24 free factor loadings estimated in the multi-group model. Four factor loadings were not significantly different from zero; 'Best Deal' Patron for the Above Average Patronage Voting sub-group, 'Best Deal' Patron for the Non-Voting Member sub-group and both the Consistent Patron and Convey Concerns variables for the District Delegates sub-group. This suggests that these indicator variables did not co-vary with the other indicator variables for the particular sub-group and may not be good indicators of free riding for the respective sub-group.

Seven pairs of un-standardized factor loadings were equal across two sub-groups.[24] The remaining six free factor loadings had unique values for each indicator variable and sub-group. The statistical significance of these values indicates the respective manifest variable does co-vary with other manifest variables and contributes information towards the description of free riding. The difference in estimated values across sub-groups suggests that the sensitivity of these indicator variables, as a measure of free riding, is different across groups.

[24] The Strong Supporter variable loadings were equal for the Below Average Patronage Voting Members and District Delegates sub-groups. The Consistent Patron variable loadings were equal for the Below Average Patronage Voting Members and Non-Voting Members sub-groups. The Read Information variable loadings were equal for the Above Average Patronage Voting Members and Non-Voting Members and equal for the Below Average Patronage Voting Members and District Delegates sub-groups. The Monitoring Activities variable loadings were equal for the Above Average Patronage Voting Members and Non-Voting Members and equal for the Below Average Patronage Voting Members and District Delegates sub-groups. And, the Convey Concerns variable loadings were equal for the Above Average Patronage Voting Members and the Non-Voting Members sub-groups.

Conclusions and Extensions:

Free riding creates problems for collective action organizations because group members are able to withhold key resources necessary to produce and supply group benefits without penalty. Withholding these resources results in an under provision of the collective benefits. Key resources may include those needed to produce group benefits, those needed to coordinate group activities, and resources needed to sustain a formal organization.

The free rider problem is commonly associated with the challenges confronting collective action and the provision of public goods. However, the free rider problem is also recognized as a challenge facing team production, where the value of team output is shared among team members and it is difficult to determine the marginal input of each individual team member. Many large private collective action organizations, like agricultural cooperatives, confront both of these difficulties. They attempt to supply member benefits which are difficult to exclude and difficult to accurately identify contributors.

Developing an accurate measure of free riding has been problematic due to the broad definition given to the concept, the wide range of activities used to describe free riding, and the latent nature of most free riding actions. The lack of an appropriate measure for free riding has made it difficult to empirically test the effectiveness of alternative strategies proposed to mitigate the free rider problem, especially the effectiveness of alternative selective incentives.

This study's primary objective is to determine if there is a dominant free riding activity which can be identified and used as the basis for measuring free riding. The paper's secondary objective is to determine whether multiple free riding actions and/or behaviors coexist within large collective action organizations. The analysis did not find a single dominant indicator, but rather multiple indicators that were significant. The good overall model fit indicated that the

single latent construct, defined as member free riding, did a good job of representing the variation and co-variation of the manifest indicator variables within the data.

The lack of a single dominant indicator suggests that free riding in large private collective action organizations may be more complex than first believed, and that focusing efforts on one indicator or proxy may not fully capture all of the key attributes of member free riding. It also provides strong evidence that an individual who free rides in one activity, which is relevant for the sustained provision of collective benefits, also tends to free ride in other key activities.

The multi-group analysis identified significant differences in the estimated mean free riding levels across three of the four identified member sub-groups. This indicates that there is heterogeneity in free riding activities across sub-groups within the same organization. The district delegate sub-group had the lowest mean level of composite free riding, while the non-voting members had the highest mean level. This suggests that historical patronage and access to voting control may be important attributes influencing free riding within this organization. The analysis also found that the relative standardized factor loadings for indicator variables varied across sub-groups, suggesting that the sensitivity of these indicators may also vary by sub-group.

Although the indicator variables chosen for this study were relatively generic and suitable for a variety of collective action settings, it is unlikely that they constitute the optimum set of measures. Additional measures for alternative free riding activities should to be tested across multiple collective action organizations to determine if a generalized set of actions and/or behaviors can be identified. These analyses may also identify unique sub-sets of free riding activities which could be useful for classifying alternative collective action organizations.

One critical refinement to the current analysis is including new or alternative measures of key member resource that are required to produce collective benefits. The single key indicator

variable intended to measure member resource contributions, the Percent Sales variable, was dropped from this analysis due to inadequate data. Withholding member resources, in particular financial resources, is one of the most commonly recognized free riding activities. Identifying and including alternative measures for key resource contributions would enhance the aggregate measure of free riding and establish the relative strength of these actions. Alternative measures could include direct equity investments, volunteered time, gifts, organization dues or fees, the dollar value of member patronage, and/or the physical amount of member patronage. An effort should be made to include indicators that measure relative or proportional resource contributions, as well as absolute measures. Absolute measures may be easier to identify, but imply that group members are homogeneous with respect to benefits received and/or individual characteristics. These measures may not fully capture withholding of key resources.

Additional indicators for group interaction activities should also to be tested and focus on activities that are needed to sustain or enhance the organization's ability to accumulate resources and coordinate member actions. Other measures could include serving on committees or boards, participating in meetings or activities sponsored by the organization, participation in new member recruitment activities, actively monitoring the conduct of other group members, or sanctioning non-collaborative member behavior.

Effort should also be made to identify and test a range of indicators which are both easy and difficult to observe by group leaders or other members. Results from this extended analysis could provide information regarding the reliability of easily observable actions relative to difficult to observe actions, and may provide insights into potential adverse selection concerns. This effort could inform the choice of measures used to link selective incentives with collaborative behavior.

Multi-group modeling techniques could also provide significant insights into the role that group heterogeneity plays in creating and sustaining collective benefits, and may also influence the design and use of targeted or selective incentives. Olson argued that the presence of a privileged sub-group within an intermediate or latent group would increase the likelihood that the group would be able to organize and sustain provision of collective benefits. Alternative sub-group stratifications could be tested to determine if privileged sub-groups exist and what characteristics delineate these sub-groups. Group heterogeneity can be defined using many different criteria including age, wealth, income, location, occupation, technology utilization, patronage, control rights or economic interests. However, some of these criteria may be more useful for distinguishing alternative levels of free riding than others.

Olson also proposed that selective or targeted incentives could be used to mobilize latent groups, and possibly mitigate free riding in privileged and functioning intermediate groups. The presence of multiple free riding activities may complicate the design and use of selective incentives. It is unclear whether a single targeted incentive would be strong enough to mitigate a set of free riding activities or whether a set of incentives would be more effective. More complex structural equation modeling techniques may help inform this question.

This study introduced an alternative method for measuring and studying free riding within large private collective action organizations. The initial findings raise many new questions regarding the description and measurement of free riding. Extensions of this initial work may lead to a better general understanding of free riding, a more refined definition of free riding and an enhanced ability to empirically test the effectiveness of alternative free riding mitigation strategies.

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Appendix Table 1: Un-Standardized Factor Loadings, Standardized Factor Loadings and *P* Values for Multi-Group *Member Free Riding* Confirmatory Factor Model and Base *Member Free Riding* Confirmatory Factor Model using the Combined Data Set.

Variable	Above Average Patronage Voting Members (*n* = 199)			Below Average Patronage Voting Members (*n* = 217)			Non-Voting Members (*n* = 99)			District Delegates (*n* = 60)			Base Model Using Full Data Set (*n* = 575)		
	Un-Std.	Std.	*P* Value	Un-Std.	Std.	*P* Value	Un-Std.	Std.	*P* Value	Un-Std.	Std.	*P* Value	Un-Std.	Std.	*P* Value
Strong Supporter	0.436	**0.471**	***	0.902	**0.586**	***	0.201	**0.277**	0.010	0.902	**0.663**	***	0.717	**0.590**	***
Consistent Patron	0.138	**0.170**	0.038	0.350	**0.236**	***	0.350	**0.380**	***	0.000	**0.000**	N.A.	0.436	**0.373**	***
'Best Deal' Patron	0.000	**0.000**	N.A.	-0.322	**-0.164**	0.069	0.000	**0.000**	N.A.	-0.717	**-0.268**	0.080	-0.275	**-0.181**	***
Read Information	0.479	**0.514**	***	0.889	**0.575**	***	0.479	**0.496**	***	0.889	**0.698**	***	0.794	**0.623**	***
Discuss Activities	1.000	**0.849**	N.A.	1.000	**0.533**	N.A.	1.000	**0.871**	N.A.	1.000	**0.504**	N.A.	1.000	**0.637**	N.A.
Monitoring Activities	0.680	**0.576**	***	1.007	**0.508**	***	0.680	**0.638**	***	1.007	**0.507**	***	0.883	**0.551**	***
Convey Concerns	0.399	**0.280**	***	0.645	**0.241**	0.014	0.399	**0.304**	***	0.000	**0.000**	N.A.	0.807	**0.382**	***
Member Free Riding Est. Mean Value [1]	2.019			2.019			1.732			2.716			2.040		
Member Free Riding Est. Variance	0.869			0.272			1.187			0.176			0.480		

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

1 A larger mean value for the *Member Free Riding* latent variable indicates a lower level of free riding activities. This is due to the scaling of the indicator variables.

Appendix Table 2: Selected Model Fit Indices for the Multi-Group *Member Free Riding* Confirmatory Factor Analysis Model and *Member Free Riding* Confirmatory Factor Model using the Combined Data Set.

Model Fit Index	Estimated Value for Multi-Group Analysis	Estimated Value for Base Model Using Full Data Set
χ^2_m	90.040[1]	48.454[2]
Root-Mean-Square Error of Approximation (RMSEA)	0.027[3]	0.073[4]
Akaike Information Criterion (AIC)	244.040	94.454
Normed Fit Index (NFI)	0.864	0.934
Comparative Fit Index (CFI)	0.951	0.948
Tucker-Lewis Index (TLI)	0.912	0.880

1 This model has 63 degrees of freedom. The *p* value was 0.014 so H_o is not rejected.
2 This model has 12 degrees of freedom. The *p* value was less than 0.001 so H_o is not rejected.
3 90 % confidence interval = 0.013 to 0.040
4 90 % confidence interval = 0.052 to 0.095