GROUP PURCHASING: AN ANALYSIS OF PERFORMANCE AND ECONOMIES OF SIZE IN PREORDER FOOD COOPERATIVES

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Abstract*

Preorder consumer food cooperatives, commonly called food buying clubs, are a well known example of participatory consumer cooperation. Members directly contribute time and effort to the group endeavor to receive the cooperative's products and services. This article develops a theory to predict when consumers will join a preorder food cooperative. It also combines previous empirical research with a multiple regression analysis of the relationship among labor efficiency, group size and sales volume to evaluate the economic returns associated with different levels of operation.

I. Introduction

Cooperative action is a social and economic phenomenon directly associated with the drama of the Industrial Revolution. Diverse groups from social reformers to farmers have organized cooperative ventures for a multitude of reasons during the past two centuries. Most have failed, and the cooperatives that have survived often seem limited in scope when compared to their founder's visions. Yet the cooperative idea continues to reappear, especially during periods of social and economic upheaval. Self-help through mutual aid does not seem to be an outmoded idea.

Participatory consumer cooperatives are organizations in which consumers not only contribute capital and patronage, but also labor. Participation is as forthright and uncomplicated as purchasing groceries at wholesale for the cooperative group, or sharing the janitorial duties in a cooperative housing project. It could also be a group of farmers who react to the shrinking farm supply system by jointly purchasing and transporting items from a more distant source.

Curhan (1972, 1975) and Hoyt (1974) have analyzed the organization of preorder consumer food cooperatives and the price savings associated with participation. This paper builds upon their survey research by developing a participatory cooperative theory and testing hypotheses deduced from it concerning the relationship between group size, sales volume, and economic returns to cooperative membership. Empirical results are based upon data collected during 1978 from 21 pre-order consumer food cooperatives in the Midwest.

II. A Theory of Participatory Cooperation

In constructing a theory of participatory cooperation we will concentrate upon a member's decision to join the group endeavor. As conditions both endogenous and exogenous to the cooperative change, the number of the members changes. If no one joins, there is no cooperative. This decision-theory approach is more general than those of previous theoreticians who commence their analysis with the profit-maximization assumption and the neoclassical theory of the business firm.[1] Cooperatives can exist and benefit their members without maximizing any particular

form of return to an individual member. Applying the calculus to joint decision problems in a cooperative requires an analyst to construct a utility function with different types of benefits as arguments for each member. These individual functions must then be aggregated into a group utility function that can be maximized by the cooperative. The incommensurables surrounding interpersonal utility comparisons make this measurement exercise very difficult and may well distract the analyst from more basic questions concerning cooperative size and growth. What one needs to know is when will a consumer join or exit a cooperative, not when is his/her utility maximized.[2/]

Participating in a preorder food cooperative involves ordering food in advance of delivery, consolidating household orders into a group order, purchasing ordered items in bulk, transporting them to a distribution point, breaking them down into household orders and collecting payment. Members usually supply all the labor needed and coordinate the cooperative activity. When deciding to join a group an individual must determine whether the price savings on his food order is adequate compensation for the time contributed to the co-op. More precisely an individual will join the cooperative if the shadow wage earned by participating is greater than the opportunity cost of time spent at the co-op.

A participant's shadow wage is a function of several factors. Equations one and two can be used to compute a shadow wage.

(1) $W = \frac{1}{1-t(y)} \frac{S}{H}$ where:

(2) $S = \frac{D}{1 - D} P$ given:

W = shadow wage ($/hr.)

t(y) = marginal tax rate; a function of nominal income, (y), and expressed as a decimal

S = total savings during a given time period (dollars/period)

H = time contributed during a given time period (hours/period)

D = price savings expressed as a decimal proportion of supermarket prices

P = purchases at the co-op in a given time period ($/period)

The individual's decision criteria can be stated mathematically as follows:

(3) Join if: $$\frac{DP}{[1-t(y)]\,[1-D]H} > C(I)$$

where: C(I) = opportunity cost of participation ($/hr.); an increasing function of real income, I.

Larger values of D, percent savings over retail expressed as a decimal, increase the shadow wage. The percent spread between co-op and supermarket prices depends upon the supermarket price level which in turn is influenced primarily by labor costs and the degree of competition in the retail market. It also may reflect transport savings if the consumer needs to travel to a distant supermarket less often and the co-op's distribution point is nearby, as would be the case in many rural or central city areas. Larger purchase volume, P, also increases the shadow wage to make joining more attractive. Spending more time in cooperative activity (higher values for H) reduces hourly returns ceteris paribus.

Change in nominal income has two components--change in the rate of inflation and change in real income. When nominal increases are due solely to inflation the marginal tax rate increases, thereby increasing the shadow wage. The opportunity cost of participation, however, remains constant because it is a function of real income. Hence the attractiveness of participation increases. This effect is stronger if inflation not only moves individuals into higher tax brackers but also results in lower

real incomes. A change in real income with no inflation (an equal change in nominal income) is the only income effect that has an ambiguous impact upon the participation decision. It increases both the shadow wage and opportunity cost.

A consumer that values cooperation for non-economic reasons may participate when the shadow wage is less than the opportunity cost. This possibility can be accommodated by adding a non-economic value factor (M) to the left hand side of equation 3. The result is:

(4) Join if: $M + W > C$

This can be written as:

(5) Join if: $W > C - M$

Stronger non-economic considerations have the same analytical effect as lower opportunity costs of participation.

Cooperative size, as measured by the number of households, can be introduced to the decision model by considering its impact upon efficiency. A cooperative is more efficient if it can distribute a given amount of groceries with lower time inputs from its members. Therefore, efficiency is measured by the ratio between time contributed (H) and the amount purchased (P) - the labor input ratio. A lower H/P ratio indicates greater efficiency and produces a higher shadow wage. What we would like to know is how efficient are preorder cooperatives, and are larger units more efficient, as measured by the labor input ratio, than smaller ones?

III. Empirical Evidence

All of the parameters contained in equations 3 to 5 are measurable; however, some present a larger challenge to survey research than others. Measuring individuals' valuation of non-economic factors and their opportunity costs is difficult. Krietner (1978, p. 141-142) found that active participants in cooperative stores were individuals who valued the social mission of the cooperative highly; however he did not identify a schedule between non-economic values and participation. Other researchers have concentrated their efforts upon measuring the shadow wage.

Curhan and Wertheim surveyed 24 preorder cooperatives in the Boston area during 1971. Detailed comparisons of cooperative and supermarket retail prices revealed that net savings of about one-third were realized for fresh produce. Savings on all other items was at best 20 percent--less in the instance of meat and more for bakery products, eggs and miscellaneous purchases. They conclude that on the average, consumers save 25 percent by joining preorder cooperatives (Curhan and Wertheim, 1972, p. 34). Curhan and Wertheim also collected data from 225 participants in the cooperatives. They combined information on purchases and time commitments with their evaluation of savings over retail to estimate shadow wages.

> "Cooperative leaders reported that member work commitments required an average of three-quarters hour per week, although members reported commitments of one and one-half hours per week. Cooperative shopping exclusive of work commitments, probably required two-thirds hours per week. The total time commitment for a typical member probably averaged one and three quarters hours per week, although the commitment for members heavily involved in cooperative operation exceeded three hours per week. Assuming average purchases by each group, this translates to savings of $3.62 per hour for the minimally involved member who did no work, $1.37 per hour for the typical member and less than $.80 per hour for involved members." (Curhan and Wertheim, 1972, p. 37)

These estimates are understated because no consideration is given to the marginal tax rate. Moreover shopping time should not be included in the time requirement estimates. The opportunity cost concept is instructive here. Since consumers are not paid to shop at a supermarket, they should not count time spent shopping at a co-op. We recalculated their estimates for "typical member" without shopping time (.67 hours) and assuming, conservatively, a 15 percent marginal tax rate. This more appropriate calculation increases the shadow wage from $1.37/hr to $2.51/hr. The federal minimum wage in 1971 was $1.60/hr.

Hoyt evaluated the economic return to participation for members of a large preorder cooperative in Sacramento, California, during 1971. A random sample of 50 members was drawn from the total membership of 366 consumers (Hoyt, 1974, p. 39). Price comparisons on all products purchased were made between the cooperative and the supermarket that respondents indicated as their shopping alternative. Two monthly orders were checked. The average cost of the monthly grocery basket purchased at the cooperative was $49.55. If purchased from the most likely alternative the same basket would have cost $63.18. The cooperative saved members, on average, 22 percent (Hoyt, p. 72). Hoyt also found that the magnitude of the price differential was not related to order size. Individuals placing large orders seemed to save, on a percentage basis, about the same as those placing small orders. Sacramento Pre-order Cooperative carries a full line of grocery, produce, fresh meat, and household items.

Although Curhan, Wertheim, and Hoyt's research was conducted in 1971, their estimates of percent price savings (D in equation 3) are reasonably accurate indicators of current conditions. The remaining determinants of the shadow wage are the marginal tax rate (t) and the labor input ratio H/P. Tax rates are linked to income levels and exhibit relatively little variation. On the other hand the magnitude of the efficiency ratio can vary considerably and have a significant impact on the shadow wage. A survey of preorder food cooperatives in the mid-west conducted during 1978 enables us to measure the efficiency of several cooperatives and evaluate the relationship between co-op size and efficiency.

Fifty-two preorder cooperatives returned the survey, but only 21 provided data suitable for this analysis.[3] An aggregate labor input ratio for each cooperative was constructed that indicates the number of hours required to distribute $20 of groceries valued at invoice cost. Hours per $20 is used rather than hours per $1.00 for convenience. The computed values of the ratio (E) have larger values, ranging approximately between one and ten. The relationship between the cooperative's aggregate shadow wage and the labor input ratio (E) is

$$W = \frac{20D}{(1-d)\ (1-t)} \quad \frac{1}{E} \tag{6}$$

Where E = hours per $20 cost of goods sold.[4]

Although aggregate performance measures convey little information about the distribution of returns among members in a co-op, they are useful for determining whether a given co-op on average, outperforms other cooperatives. There are a number of factors that explain the variation

in a cooperative's labor input ratio, and in turn the shadow wages earned. Multiple regression analysis can assess the relative importance of some underlying factors, including the number of member households, the cost of goods sold per distribution, the average size of household orders, and the cooperative's product mix.

Number of Households.

When the number of households in a pre-order cooperative increases, the amount of time required to coordinate the ordering and distribution process increases. Coordination depends very heavily upon communication among all members of the cooperative. As the number of members increases, the communications network becomes more formal and time consuming. It becomes difficult to obtain agreement. Therefore transactions within larger groups not only take more time, but also may take more time per unit of sales--a diseconomy of size. As the cooperative grows larger and more impersonal, peer group pressure also becomes a less effective control for free riders. More members, perhaps due to frustration and impatience with time consuming group processes, become lax in their cooperative responsibilities. For these reasons we hypothesize that the number of households is positively related to the labor input ratio, i.e., larger groups require more time per unit of sales to distribute groceries.

Cost of Goods Sold per Distribution (CGD).

This variable is calculated from annual cost of goods sold and the number of distributions per year.[5] It measures a second dimension of size that is indicative of the physical distribution process rather than decision-making. Although preorder cooperatives differ from other

retail businesses, including cooperative stores because they have very low investment in fixed plant and equipment, they may still enjoy throughput economies. Handling small volumes of goods is not conducive to specialization or full utilization of volunteer labor. Setup and cleanup tasks can represent significant time costs. Preorder cooperatives handling larger volumes per distribution can allocate these fixed time costs over a larger volume. Therefore increasing costs of goods sold per distribution can be expected to lower the labor input ratio (E) of the cooperative.

Average Order Size (S).

The average order size measured by cost of goods sold per household (CGD/H) is an alternative measure of physical distribution economies. Average order size is expected to be negatively related to the labor input ratio when introduced in lieu of CGD. Larger orders per household enable a given group of households to allocate fixed time commitments, e.g. set up and clean up, over more grocery sales.

Binary Product Group Variables (P24, P3).

Products handled by a cooperative vary in their value and time requirements for distribution. Low cost bulk items requiring repackaging, such as flour and beans, require large inputs of time relative to their value. Products requiring less handling, such as plastic or aluminum wrap, or high value items such as fresh meat may be expectived to have a low time input per $20 of sales. At another point in this research, products were classified into five groups, based upon their handling characteristics. This was done to examine preorder cooperatives'

procurement and product line expansion patterns. The subsample of 20 cooperatives currently being analyzed however, only carrys products in the first four groups. Product group one contains dry goods such as flour and beans, canned goods and dairy products--mainly cheeses. Group two contains household items, books, and health and beauty aids. Group three has eggs, prebaked goods and fresh produce. Group four has frozen foods and fresh meat. Note that group two and group four contain products that are relatively more expensive or easier to distribute than group 1 products. Therefore, a co-op with products in these groups (P24 = 1) is expected to have a lower labor input ratio (E) than other cooperatives. Group 3 products are more expensive than group 1 products, but their increased value may be cancelled by the increase in time requirements to distribute them. Therefore, it is unclear whether a co-op that carries group 3 products (P3 = 1) has a higher labor input ratio.

One way to summarize these hypotheses is to present them in algrebraic form.

$$(7) \qquad E = a_0 + a_1 H + a_2(CGD \text{ or } S) + a_3 P24 + a_4 P3 + \varepsilon$$

Where: E = the labor input ratio (Hrs/$20 COGS)
H = the number of households
CGD = the cost of goods sold per distribution
S = average order size
P24 = binary variable identifying product groups two and four
P3 = binary variable identifying product group three
ε = the disturbance term

Table 1 presents the statistical results of the multiple regression analysis. Equation one evaluates the linear relationship between the

Table 1. MULTIPLE REGRESSION EQUATIONS EXPLAINING LABOR EFFICIENCY IN PREORDER CONSUMER FOOD COOPERATIVES a/

Equation	Intercept	Households (H)	Cost of Goods Per Distribution (CGD)	Average Order Size (S)	Product Groups 2 and 4 (P24)	Product Group 3 (P3)	Number of Observations	R^2	F-Ratio
1)	1.43	.0304 (3.20)**					21	.350	10.23**
2)	2.00	.0564 (3.88)**	-.00225 (2.23)*				21	.491	8.67**
3)	2.55	.0258 (2.64)**		-.0041 (1.45)+			21	.418	6.47**
4)	2.02	.0371 (4.10)**			-1.22 (1.65)+	-.0864 (.09)	19	.532	5.69*
5)	2.00	.0537 (3.392)**	-.00181 (1.27)		-.451 (.48)	.0296 (.03)	19	.581	4.84*

a/ Significance levels: ** = 1 percent, * = 5 percent, + = 10 percent

labor input ratio (E) and the number of member households (H). The coefficient for H is positive as hypothesized and statistically significant at the five percent level. The number of households in the sample range from 7 to 175 with all but one co-op falling at or below 100 units.[6] One hundred households require on average two and one half times more labor input from members than does a forty-household co-op to distribute groceries. The R^2 value indicates that the equation explains 35.0 percent of the observed variation in E.

Equation two introduces cost of goods sold per distribution to evaluate the influence of physical distribution economies as well as the coordinating diseconomies measured by H. H becomes more strongly and positively associated with the E ratio; that is co-ops with more members tend to be less efficient as hypothesized. CGD is negatively related to the labor input ratio as hypothesized, and the coefficient is significant at the five percent level. Higher throughput leads to fewer hours per $20 of sales. The equation explains 49.1 percent of the variation in E and is significant at the one percent level with an F-ratio of 8.67.

Average order size (S) is introduced in lieu of CGD in equation 3 and performs as hypothesized. It is negatively related to E and significant at the 10 percent level suggesting that larger orders require less time per $20 of sales. However, average order size is less effective than CGD in distinguishing between decision-making and distribution economies. Not only is the t-value on H lower, the R^2 is substantially lower as well, yet the overall model remains significant at the one percent level.

The binary variables P24 and P3 are introduced in equation 4 along with number of households. H remains positively and significantly associated with the labor input rates. Co-ops whose product mix covers groups two and four, the relatively expensive and easy to handle items, have lower E ratios as hypothesized. The relationship is statistically significant at the 10 percent level. The P3 product binary indicating distribution of eggs, baked goods and fresh produce has no significant influence upon the labor input ratio. R^2 is .501 and the F-ratio is adequate to guarantee overall significance at the five percent level.

The final equation introduces CGD jointly with the product group variables and number of households. Its results are as hypothesized, however, some multicollinearity between CGD and P24 causes each to lose statistical significance. This is to be expected. Other things remaining constant, co-ops carrying goods in groups two and four--high value easy to handle items--would have higher sales per distribution. This model explains 58.1 percent of the variation in E and is significant at the five percent level with an F ratio of 4.84.

Although this analysis rests upon only 21 cooperatives, it does suggest that two dimensions of size--the number of households and sales volume--strongly influence the average efficiency of preorder cooperatives. To interpret further the relative impact of these factors on performance we will use equation 2 of Table 1--the most robust model containing both of these explanatory variables. The size and magnitude of the coefficients in equation 2 indicates that, for a given level of sales (CGD), preorders with more households are less efficient than those with fewer units. Yet one must be careful here, because

this equation measures the observed relationship among several cooperatives rather than what occurs when a given cooperative grows. In most instances, sales will go up when new households join a cooperative. To analyze the net influence of expanding a cooperative's membership, it is convenient to rewrite equation 2 of Table 1 making use of the Definition CGD = SH:

(8) $$E = 2.00 + .0564\ H - .00225\ SH$$

The influence on the labor input ratio of adding new households depends upon the level of average order size (S). The impact of adding new members is as follows:

positive (less efficient) if S is less than $25.
zero (no change) if S equals $25
negative (more efficient) if S is greater than $25

The explanation for this complex result is straight-forward. For order sizes less than $25 the increased time required for decision making and group coordination are only partially offset by the physical distribution economies due to increased sales; at $25 the diseconomies and economies exactly off-set each other; and for larger average order sizes coordination diseconomies are more than offset by throughput economies.

One should not regard $25 as a magic number. This analysis primarily establishes the concept of a switch point; its precise value will vary over time. As food prices rise, for example, the switching value will also rise.

Figure 1 uses the results of our labor efficiency analysis to determine the average shadow wage enjoyed by households in different

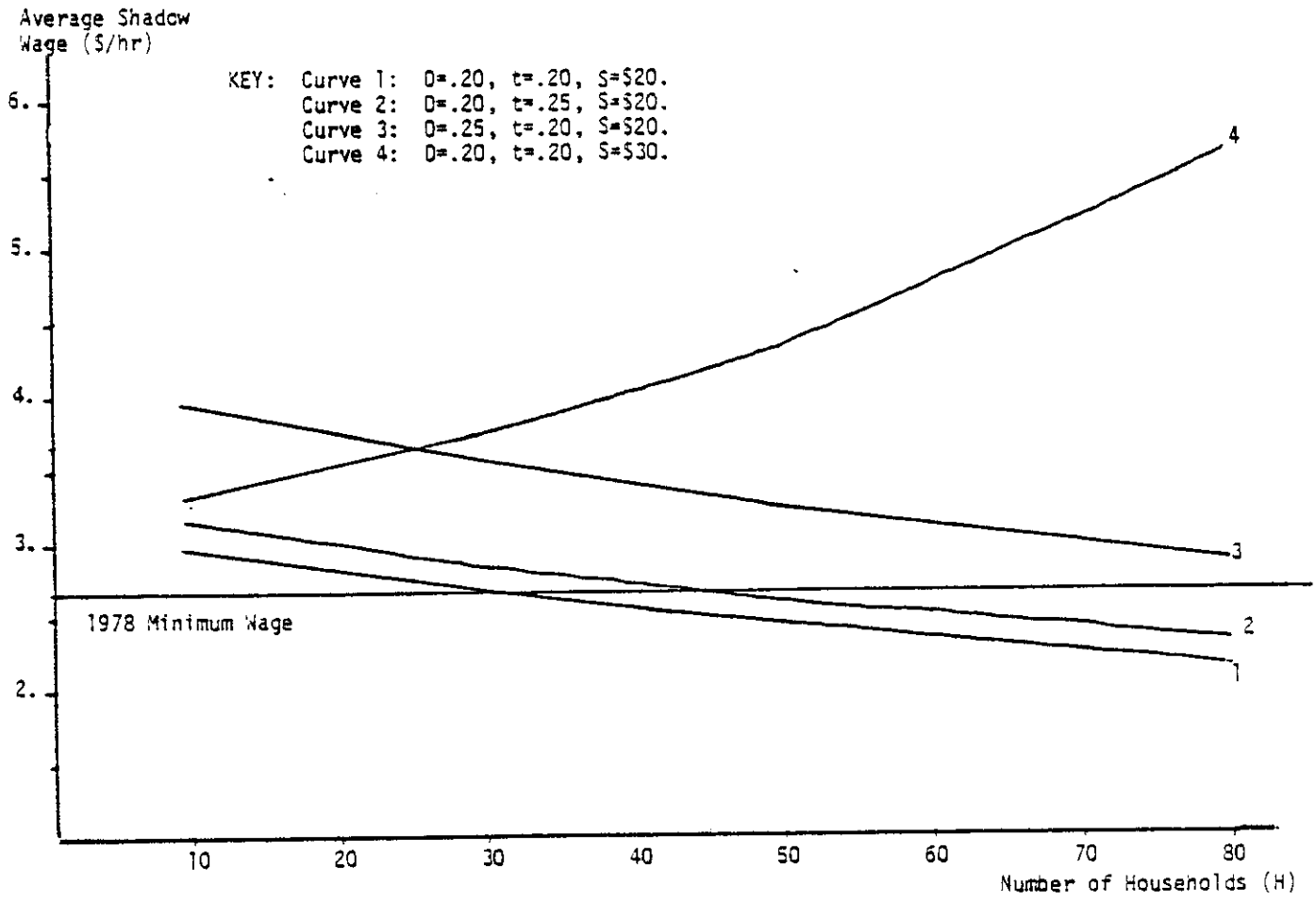
sized cooperatives. The general equation for these curves can be obtained by substituting equation 8 into equation 6. Values for all variables other than number of households are held constant at the indicated levels. The most striking fact is the impact of average order size. Curve 1 assumes 20 percent savings over retailing, a 20 percent marginal income tax rate, and an order size of 20 dollars per household. (The average order size in this sample of 21 cooperatives is $20.42). Since order size is less than $25, curve 1 has a negative slope. Increasing average order size to $25 would not only shift curve 1 up, it would also rotate the curve until it is a perfectly flat line at $3.12/hr. This curve is not drawn in Figure 1; however, curve 4 illustrates the impact of increasing order size to $30; the group size-wage relationship shifts upward and becomes strongly positive.

Curve 2 assesses the sensitivity of shadow wages to changes in the marginal income tax rate. A twenty-five percent increase in the tax rate from t=.2 to t=.25 produces a modest upward shift in the curve. Increasing savings over retail (D) twenty-five percent from .2 to .25 has a stronger impact on the group size-wage relationship, shifting it upward from curve 1 to curve 3. In fact, the impact of a twenty-five percent increase in D from .2 is five times greater than the same percent increase in t from .2.[7]

The curves in figure 1 also provide insight into the dynamics of cooperative growth and equilibrium group size. Commencing with an instructive, heuristic case, assume the following:

Figure 1.

Figure 1. The Relationship Between Number of Households and Average Shadow Wage Given Values for Savings Over Retail (D), the Marginal Income Tax rate (t) and Average Order Size (S)



1. The minimum wage is the opportunity cost for all potential members.
2. All potential members are in the 25 percent marginal tax bracket.
3. All members save 20 percent on co-op purchases.
4. All members purchase $20 per month at the co-op.
5. All members contribute an equal amount of time to the co-op.
6. Individuals can join or quit the co-op at will.

These assumptions guarantee that this cooperative moves along curve 2 in figure 1, rather than jumping to nearby curves when group size varies. Note that curve intersects the opportunity cost line at 45 households. Any group with less than (more than) 45 members will earn shadow wages above (below) opportunity cost, hence individuals will join (exit) the group. The cooperative's equilibrium size is 45 households.

The dynamics are qualitatively if not quantitatively similar when one or more of the first five assumptions are relaxed. The stable equilibrium at 45 households is destroyed. Consider, for example, relaxing only the first assumption. When opportunity costs vary among individuals, there will be outsiders who have lower opportunity costs and hence will join the cooperative at any given size. As they join, the co-op group moves down curve 2 in Figure 1 becoming a larger group composed of individuals with lower opportunity costs.[8] The dynamic is similar when one relaxes the homogeneity assumption for one or all of the following: marginal tax rates, percent price savings, order size, and hours worked. The co-op will evolve towards a larger group of individuals that have low opportunity costs, high marginal tax rates, purchase products with a high percent price savings, place large orders, and work as little as possible.

The dynamics associated with heterogeneity in the population suggest that preorder groups, which have average order size less than $25 and seek to sustain or increase shadow wages, will impose limits on group size. Nearly all preorder cooperatives in the midwest limit group size. Table 2 provides some empirical evidence on the dynamics of preorder cooperative size. It classifies co-ops by age and size. Of the forty-nine responding midwestern preorders; fourteen were less than one year old and 43 were less than four years old; and one was more than 6 years old. Older pre-order cooperatives tend to have more members. One would expect that these larger older co-ops have mastered the preorder distribution process, have a reasonably high sales per household, and sustain a reasonably savings for members on an hourly basis. Yet note that four of the six co-ops more than 4 years old and twenty of the twenty-four pre-orders more than two years old have sixty or fewer households. This suggests that the trend towards larger groups as co-ops age is not moving towards extremely large groups. Rather, it appears that most (but not all) neighborhood groups start with less than 30 households and increase their membership but limit group size at a level between 30 and 60 households.

Curhan and Wertheim observed a similar phenomenon when they re-examined twenty-four preorder food cooperatives in Boston three years after their initial survey. Writing in 1974 they observed:

Table 2. The Relationship Between Age and Size of Preorder Cooperatives

	less than 12 mon.	12 to 23 mon.	24 to 47 mon.	48 to 72 mon.	Total
Less than 30 households	8	8	7	1	24
30 to 59 households	4	2	6	3	15
60 to 89 households	2	1	2	1	6
90 to 119 households	0	0	2	0	2
120+ households	0	0	1	1	2
All Preorder Cooperatives	14	11	18	6	49

* The correlation between age and group size is .42, and is significant at the one percent level.

> ...Cooperatives have overcome operating difficulties and achieved a kind of stability and maturity...(They) appear able to handle an annual turnover of membership of 30 to 35 percent without undue disruption. Although average membership has nearly doubled, most ... cooperatives have elected to restrict their size usually to between 30 and 50 members. Many have waiting lists.[9/]

The participatory theory developed above and evidence from the Midwest suggests that most preorders after limiting group size attempt to increase returns by expanding sales per household. To a large degree their ability to do this depends upon how rapidly their federation warehouse expands its product line. A family can only consume a limited quantity of the items commonly supplied by federations--flours, beans, selected canned goods, cheeses, nuts and dried fruits. As the wholesaling system expands product offerings and co-op members increase order size, limiting group size may become less important as a method to sustain or increase the economic benefits of cooperation.

The ultimate size of preorder cooperatives that enjoy high sales per household is probably determined by two factors not introduced in this model. Percent savings over retail, assumed constant in this analysis, may decline as the product line expands. Secondly, larger groups need more permanent distribution space, leadership, and management. Since these are seldom "free goods" larger preorders incur expenses that may limit the increase in benefits associated with increasing membership. In both cases, curves such as Curve 4 in Figure 1 would then peak at some group size suggesting an optimum group size; yet under general conditions group size would have to be limited at this level. Otherwise membership would continue to expand as explained previously.

Many large preorders may become preorder grocery warehouses such as the Sacramento Co-op analyzed by Hoyt (1974). These units usually supply between 500 and 1,000 families that are organized in neighborhood "blocks" of 12 to 20 families. Blocks function as small preorder units which in turn submit caselot orders to the central distribution facility. Preorder grocery warehouses are a new retailing format that can combine group action with computerized ordering and bulk handling techniques to reduce costs of food distribution substantially below those of conventional supermarkets.[10/]

IV. Conclusions

The theory of participatory consumer cooperatives developed in this article provides a framework for conducting empirical research. Whether a consumer will join a pre-order food cooperative requiring direct participation depends upon whether the shadow wage earned is greater than the opportunity cost of foregone alternatives. To the extent that non-economic factors enhance the decision to join, they correspond, ceteris paribus, to lower opportunity costs.

Empirical research has not completely identified the exact relationships among all of the factors that influence the decision to join a participatory cooperative. For preorder food cooperatives, Curhan and Hoyt have measured the percent price saving accruing to members and calculated shadow wage levels. These efforts, however, did not consider the impact of marginal tax rates or scale of operation. The present study incorporates tax considerations and explores the relationship between the labor input ratio and three measures of

cooperative size, the number of households, cost of goods sold per distribution, and average order size. After assuming a marginal tax rate, and a level of price saving consistent with Curhan and Hoyt's results, it was possible to analyze the relationship between these measures of size and the average shadow wage enjoyed by co-op members.

Decision-making diseconomies more than offset the physical distribution economies if average order size per household is less than $25. Therefore larger groups experience lower average shadow wages. If volume per household was above $25 in this analysis larger cooperatives, as measured by number of households, enjoy higher average shadow wages.

Further empirical research could improve our understanding of participatory consumer cooperatives. For preorder food cooperatives, it would be useful to measure the opportunity cost of different classes of consumers and to evaluate the relationship between opportunity cost and changes in real and nominal income. Estimates of the level and variation in opportunity costs could then be combined with the foregoing research on cooperative labor efficiency and shadow wages to predict more accurately the type of consumer best served by preorder cooperatives and their potential as retail distribution systems.

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FOOTNOTES

1/ See, for example, Carson (1977)

2/ The theory developed here is specific to preorder cooperatives which are admittedly a special case because they require little investment in inventory or fixed assets. Thus capital investment aspects can be ignored; only purchase and labor input decisions need to be explained. Generalization is straight forward, requiring only more mathematics and more complex decision rules.

3/ One cooperative that furnished data was not included because it was in transition to a store. Another is not included because with 300 members it is substantially larger than the other cooperatives, that range from 7 to 175 households with all but one less than 101 households.

4/ See (Cotterill, 1979) for further analysis of the relationships between the shadow wage and the arguments of this function.

5/ Cost of goods sold is used instead of sales because it is a more accurate indicator of the cooperatives long-run volume. The two measures are nearly identical except for a few preorders that have gross margins above 10 percent to accumulate reserves. Such large margins are probably temporary changes. The correlation between cost of goods sold and sales is .995.

6/ This relationship remained statistically significant when the equation was estimated after deleting the 175 household observation.

7/ The ratio of wage elasticity with respect to D and wage elasticity with respect to t is: $\frac{n_D}{n_t} = \frac{1-t}{(1-D)D}$

Evaluating this ratio at t=.2, D=.2 gives

$\frac{n_D}{n_t} = 5$

Ratios of elasticities involving the wage elasticity with respect to changes in S or H are complicated functions of several variables and not easily summarized.

8/ The logic for this conclusion is as follows. When a person whose opportunity cost is below minimum wage joins the 45 members, returns for the 46 member group moves below the opportunity cost of the 45 original members. One member quits, re-establishing a 45 member group. As more individuals with opportunity costs below minimum wage join, more of the 45 members quit until none of them remain in the group. At that point the group size expands to more than 45 members because all members have lower opportunity costs. Since this process can continue ad infinitum there is no equilibrium group size.

9/ Curhan and Wertheim, (1975), p. 24). This conclusion applies to "surburban" buying clubs as opposed to two other categories of preorder cooperatives: "young" co-ops consisting of counterculture youth in downtown boston and "urban" co-ops consisting of limited income minorities organized into co-ops by government anti-poverty workers. "Surburban" co-ops consisting of neighborhood groups and primarily young families most closely approximates the current sample.

10/ See Shenkel, "Our Co-op: A Preorder Grocery Warehouse Distribution System" in R. Cotterill, ed., Building a Cooperative Food System forthcoming) for further information on such retailing systems.