Community Supported Agriculture (CSA):

A Hypothesis Test of Membership Activities and Utility

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Introduction:

Community Supported Agriculture (CSA) is a production and marketing practice of food products that emphasizes organic or nearly organic farming and direct connection between consumers and farmers (Kolodinsky and Pelch). Consumers who join a CSA farm pay a membership fee in exchange for receiving a share of the produce each week during the harvest season (Demuth). Under this practice, some of the farming risks are distributed back onto consumers, and consumers have a chance to become more involved in the process of growing their food. Consumers may also feel more connected to both the food system and the natural environment. CSA results in an economic relationship that includes values other than just locally grown food. It affords farmers a security that is not often achievable without large-scale operations, and offers consumers greater contact with the producers of their food and with the farming process. CSA movement began in Europe about 30 years ago when farmers decided to do something about the fact that they were losing market shares as well as the ability to produce diverse crops (Cohen). The birth of CSA movement in the US occurred in the mid 1980s. It is estimated that there are at least 566 CSA farms in the US and Canada and hundreds more around the world (Bio-Dynamic Farming and Gardening Association).

Several studies have examined different issues of CSA farms (Demuth, Kolodinsky and Pelch, Cohen et al.), but it is unknown whether the members of CSA farms obtain utility directly from their time spent in certain activities associated with their membership. This study contributes to the literature by examining this possibility using data from a survey of CSA members. Specifically, this study examines two major time use activities: picking up produce from a CSA farm and cleaning and putting away the produce at home. These activities are clearly inputs into the production of meals at home. The hypothesis to be tested in this study is that time spent in these two activities not only provides utility indirectly through the consumption of household produced goods (meals), but also provides utility directly. The following sections review a utility maximization framework developed by Graham and Greene, describe the data set, present the estimation results, and discuss major findings and conclusions.

Method:

Time allocation theories suggest that time is only important as a scarce resource and generally provides utility indirectly through household produced goods (Becker, Gronau). Since the early inception of time use research, the idea of "joint production" of time in the production of goods and leisure has been noted but has generally been dismissed. Graham and Greene empirically tested whether time is capable of providing "joint production" and suggested that there is a "substantial jointness between home production time and leisure." Kolodinsky also suggested that time as an input yields utility directly in the case of time spent searching for price information for food products used in meal production.

Becker proposed a utility function in which goods are produced in the home from purchased inputs and time and individuals obtain utility from consuming these goods. Graham and Greene developed a framework that includes both purchased goods and home produced goods in a generalized household utility function. This study uses this framework to test the hypothesis that time spent in CSA related activities could yield utility directly.

According to Graham and Greene, a household utility function including the composition of market goods and goods produced at home can be written as:

(1) $U = U\{[Xm + Z(Xz, M^{b}H)], L\}$

where U is total utility, L is total leisure, Xm is a vector of goods purchased in the market, Z is a vector of goods produced at home, Xz is a vector of goods purchased for use in home production, M is a measure of productivity or human capital, b is a positive parameter which indicates whether the household is less, equally, or more productive at home than in the marketplace, and H is time spent in household production. The budget and time constraints are:

(2) $Xm + Xz = WN + v$

(3) $T = l + H + N$

where W is the market wage rate, N is hours spent in market work, v is non-labor income, T is total available time and l is normal leisure time. Under the assumption of joint production (Graham and Greene), the total leisure (L) includes two components:

(4) $L = l + g(H)$

where g(H) is the leisure contributed by household production and g(H) is a function which satisfies a set of conditions (Graham and Greene). As suggested by Gronau and implemented by Graham and Greene, we express the household production function in a Cobb-Douglas form:

(5) $Z = A(M^b H)^{\gamma} Xz^{\beta}$

where A is a general scale parameter indicating the size of household because productivity changes as the scale of the home/household changes, and γ & β are returns to scale parameters which reflect the marginal productivity of household time and goods, respectively. As shown by Graham and Greene, the following function satisfies the conditions for the joint function:

(6) $g(H) = H - (1/T^{\delta})[(H^{1+\delta})/(1+\delta)]$

where δ is the parameter that measures jointness of utility from time spent in household production.

Maximizing the utility function subject to the constraints results in the following first order conditions are:

(7) $\quad BA(M^bH)^\gamma Xz^{\beta-1} = 1$ and $\gamma AM^{b\gamma}H^{\gamma-1}Xz^\beta = W(H/T)^\delta$

Solving the equations simultaneously for H and expressing the solution in log-linear form yield the following function:

(8) $\quad \ln H = c + \{1/[(1-\beta)(1+\delta) - \gamma]\}\ln A + \{(\beta-1)/[(1-\beta)(1+\delta)] - \gamma\}\ln W - \{b\gamma/[(1-\beta)(1+\delta) - \gamma]\}\ln M$

where c is a constant. The above equation can then be rewritten as:

(9) $\quad \ln(H_1) = c + k\ \ln(A) + l\ \ln(W) + n\ \ln(M)$

where $k = 1/q$, $l = (B-1)/q$, $n = b\gamma/q$, H_1 = time spent in household production, and q is a common term, $q = (1-B)(1+\delta) - \gamma$, which helps to simplify the equation.

In the joint production model represented in equation (8), the parameters γ, b, δ, and β are solved in terms of the coefficients of the log-linear equation (*n, l* and *k*):

(10) $\quad \gamma = n/k$, $\beta = (l+k)/k$, $b = -n/[1+l(1+\delta)]$, $\delta = (n+1+l)/(-l)$.

Because the system of equations to be estimated is underidentified by one, one more restriction is needed in order to uniquely identify δ, b, β, and γ. We examine two possible restrictions in the empirical analysis: neutral productivity — time is equally productive in the household and market (b = 1), and constant returns to scale in household production ($\beta + \gamma = 1$).

Data and analysis:

The model presented above is used to examine empirically whether time spent in two household production activities related to CSA yield utility directly. The decision to join a CSA farm involves the allocation of time and money for the objective of maximizing utility. Since most members do not subsist entirely on food obtained from the CSA farm, they must spend some time shopping at other food marketing outlets in addition to the time spent in picking up and processing the raw vegetables from the farm. In the CSA model, consumers come to a farm and pick up the weekly array of produce in bulk form. For example, carrots typically have tops and peas are unshelled and must be picked by members. Thus, in addition to making an "extra trip" to pick up produce from a separate outlet than other grocery items, consumers must spend time at home preparing the produce for use or for storage. These activities are clearly inputs into the production of meals in a household. Our analysis focuses on two time-use activities of CSA members: picking up produce from farms and putting away produce at home. These details about CSA farms indicate that many members of CSA farms make conscious choices to spend more time in meal production. This seems to directly contradict the general observation of a historical trend away from household food production (Bryant, Fenstermaker, Robinson). One possible explanation is that CSA members obtain utility directly from their time spent in membership activities in addition to the utility obtained from producing meals. Graham and Greene proposed that household production can yield utility through two ways: household produced goods yield utility and the act of production itself also can yield utility.

Data used in this study are from a survey of CSA members in the state of Vermont. Survey questions were developed with the input of several CSA farmers and members and the survey was conducted according to Frey's Survey Research by Telephone. The surveys were pretested on the members of a CSA farm that did not participate in the study. Results from the pretesting process were used to revise the surveys. The CSA farms were chosen to represent different regions and the sizes of CSA farms within the state. Member phone numbers were obtained from the farms. Data were collected using the CI2 Computer Assisted Telephone Interviewing (CATI) system at the University of Vermont in October 1995. Members of three CSA farms in Vermont were surveyed. The population of members was 277 and 184 of them completed the survey, yielding a response rate of 66%.

Information gathered from this survey includes shopping behavior, factors relevant to time devoted to CSA member activities, where respondents shop for produce, whether they compost and recycle, and what their eating habits are like. Demographic information was also collected for all respondents. Most of the demographic questions relate to information about the household, while a few refer specifically to the respondent (e.g., age and education level).

We collected data on each respondent's time use activities associated with his or her CSA farm membership (e.g., time spent at the farm picking up produce, and time spent cleaning and putting away produce at home). With such detailed time use data, we are able not only to test whether time spent in household production yields utility directly, but also to test whether time spent in different types of activities yield utility. Modeling two different time use activities also helps to validate the methodology.

Equation (9) includes three parameters (k, n and l). Empirically, k must include measures of household production efficiency. As shown in Table 1, we include a set of variables that may affect household ability to be productive in activities related to productivity as a member of a CSA farm. **Shop1-Shop7** are dummy variables that describe the types of food buying behavior exhibited by the responding household. These variables range from describing a household in which organic produce is usually purchased in the "off CSA season" and selection is important (**Shop2**) to households that do not purchase organic produce in the "off season" but the household joined the CSA because they considered joining a CSA farm a socially responsible behavior (**Shop7**). These variables may influence the efficiency in which a household engages in time use activities associated with CSA membership, and help to describe the conditions under which each household operates in the market place. For example, while organic produce is widely available, not all consumers choose to purchase it. Some individuals' behavior is influenced by price differentials, while others care about selection or convenience. **Eatout** measures how many meals were eaten away from home in the previous month. Households who purchase meals outside the home may be less efficient in household activities related to meal production. **Yrsmem** measures the number of years a household has belonged to a CSA farm. Presumably, the longer a household is a member, the more efficient it becomes at CSA activities. **Garden** is a dummy variable that represents whether the household has a home garden. Households that engage in activities related to "raw" produce should be more efficient at CSA activities. **Supermkt** is a dummy variable that measures whether a household usually purchases groceries at a supermarket versus a cooperative, farm market, or other outlet. **Kids12** is a dummy variable that measures the presence of children under age 12 in the household. Addition of children to a household is expected to increase productivity in household activities (Bryant). **Marwom** is a dummy variable that equals one if the respondent is a married woman. Theory tells us that married women tend to be more productive in household activities (Bryant).

Empirically, n must include measures that increase both market and home productivity of a household, and as such is a general measure of productivity. Like what Graham and Greene did in their study, we include both the age of the respondent (**age**) and educational attainment (**educ**).

Finally, l is a measure of the value of time. Our data do not allow us to use the wage of the respondent as would be ideal. We only have a measure of household income (**income**). It is possible that the coefficient may be biased because it contains a production substitution effect and possibly an income and consumption substitution effect. We expect the production substitution effect on household hours to be negative. As market work becomes more productive, individuals substitute into that time use. Given that leisure is a normal good, we would expect that the income effect of an increase in wages would decrease market work and increase leisure time. It would not affect household production time. The consumption substitution effect also only effects time spent in leisure and market work (Bryant). When household time *does* yield utility, then using income as a proxy for the price of time (*l*) includes a tradeoff between market work, pure leisure and the portion of household production that provides leisure. A rise in the price of time would increase the portion of household production that provides utility. Because household time has components of leisure, there is a possibility that the consumption substitution effect, which usually affects only market work and leisure, also affects household production time. When the price of time rises, leisure becomes relatively more expensive. An individual will substitute out of leisure into market work. This effect would mediate the income effect. Thus, our estimates include the usual production substitution effect (negative on household time), an income effect (positive on the portion of household time that yields utility) and a consumption substitution effect (negative on the portion of household time that produces utility). Therefore, we can not ascertain the exact nature of the bias but we know the two components contributing to it oppose each other. Given that the production substitution effect operates on the whole of household production and the two other competing effects operate only on the portion of household time that yields utility and are of opposite signs, the bias may not be large.

Two regression equations in the double-log forms are estimated using the survey data. The equations can be estimated using the ordinary least squares (OLS) regression procedure, but the fact that only members have values associated with the dependent variable are included in the estimation may create the possibility of sample selection bias. When this possibility of sample selection bias is tested using Heckman's procedure, results indicate that there is no indication of bias because the estimated lambda is insignificant for both equations. Table 1 presents the variable definitions and the OLS estimation results for both equations.

We find similar results to Graham and Greene regarding the elasticity of household production with respect to market goods, returns to scale, productivity of time spent in market versus homework, and jointness of home production time and leisure. However, our results are more consistent and appear robust. We find that our hypothesis that time may yield utility directly can not be rejected. Each of the three coefficients of the theoretical equations (*k*, *l* and *n*) is obtained by summing the coefficients of the variables under the corresponding vector and these three coefficients are then used to determine the values of the parameters δ, β, γ, and b. These results are shown in Table 2. For both time use activities, δ is consistently positive under both assumptions (neutrality and constant returns to scale). Based on our estimations, households appear to obtain more utility from picking up produce and spending time at the CSA farm than from putting away produce at home.

The major objective of this research was to test the hypothesis that time may yield utility directly. However, other results based on the underlying assumptions which had to be placed on the household production function are useful to examine in order to see whether our estimates are consistent. First, when constant returns to scale is not imposed, returns to scale ($\gamma + \beta$) are calculated to be 1.02 for pickup time and 0.99 for putaway time. As with Graham and Greene's results, we have no confidence intervals around these results. Therefore, we can not rule out constant returns to scale in household production. This is reassuring, given that, theoretically, the Cobb-Douglass production function is homogeneous of degree 1. Second, the elasticity of household production with respect to purchased inputs exceeds the elasticity with respect to time. In all cases β is very close to 1 and is larger than γ. Third, in contrast to the findings of Graham and Greene, we find that households are more productive in household work compared to market work. In the case of CSA farm activities, when utility is obtained directly from time use activities, household members are more productive in that time use than in the market.

Conclusions and discussion:

This research moves ahead our understanding of household time use. First, it addresses a time use issue beyond anecdotal evidence that time spent in certain household activities yields utility directly. Although using a restrictive form of a household production function (Cobb Douglas) is limiting in that it produces constant elasticities across all values of the independent variables, our results are consistent and robust across different assumptions used to identify the household production equations. It appears that households do obtain utility from time spent in activities related to CSA farms. In our application, individuals appear to obtain more utility from going to the farm than from having to clean and put away produce at home, although both were found to yield positive utility.

As one limitation of this study, we used household income, rather than wage rate or an estimated reservation wage rate for those unemployed in the labor market, to represent the value of time in order to estimate δ, β, γ, and b. This data limitation may result in biased estimates of the coefficient. Bryant reviewed the literature and found that the production substitution effect tends to prevail in the case of women. Because men spend less time in household production, the effect of a change of the wage rate on household time would be smaller. Any bias affects γ, b, β and δ because l is used to compute these parameters in all cases except for the calculation of γ under the assumption of neutrality of time productivity in the household and market (b = 1). Looking at our estimates of γ, they vary by only .02 in the case of pick up time and .04 in the case of putaway time. Given this discussion, the overall size of the bias is not likely large.

Importantly, this study has examined the “next level” of the study of household time use:

time itself must be considered as an input into other outcomes. In this case, the outcome is utility. Clearly, more research must be conducted in the area of household time use in order to explain the nuances of time use choices. In the particular example studied, however, it seems that *going to the farm is more than just household production.*

CSA has a relatively short history in the US but has shown a growing trend in many regions. Although many factors may contribute to an individual's decision to be a member of a CSA farm, this study suggests that CSA members obtain utility (satisfaction) from membership activities in two ways: directly from the time use activities and indirectly from the consumption of home produced goods (meals).

Table 1. Descriptive Statistics and Regression Results: Time Spent in CSA Related Activities

Name	Definition	Mean	Pickup Time	Putaway Time
Dependent Variables				
Pickup	Minutes spent picking up produce weekly	58.60	n.a.	n.a.
Putaway	Minutes spent putting away produce weekly	25.20	n.a.	n.a.
Intercept			1.95	-4.16*
Measures of Household Productivity				
Shop1	1=buys organic and convenience is important	0.07	0.70*	0.65*
Shop2	1=buys organic and selection is important	0.19	0.63*	0.20
Shop3	1=buys organic and price is important	0.01	2.8*	2.6**
Shop4	1=buys organic and being socially responsible is important	0.12	0.60	0.30
Shop5	1= does not buy organic and selection is important	0.20	0.16	-0.36*
Shop6	1=does not buy organic and price is important	0.05	0.80*	-0.11
Shop7	1= does not buy organic and is socially responsible	0.07	0.09	0.72**
Eatout	Number of times has eaten out in past month	8.60	0.26**	0.10
Yrsmem	Years a CSA member	2.10	-0.12	0.25*
Supermkt	1=shops at supermarket in “off season”	0.56	-0.08	0.02
Garden	1= has a home garden	0.35	-0.37*	-0.21
Kid12	1= presence of children under age 12	0.40	0.44*	0.35**
Marwom	1= married female	0.51	-0.08	0.33**
Measures of General Productivity				
Educ	Education in years	16.0	0.54	1.07*
Age	Age of respondent	40.4	-0.25	0.98***
Measure of the Price of Time				
Income		32,960	-0.04	-0.35***
Adj. R^2			0.13	0.14

Table 2. Estimates of the Production Function Parameters

	δ	γ	β	b
Pickup Time				
Case 1-neutrality	24.8	0.03	0.99	1.00
Case 2-Constant returns to scale	20.0	0.01	0.99	5.80
Putaway Time				
Case 1-neutrality	7.28	0.08	0.88	1.00
Case 2-Constant returns to scale	2.85	0.12	0.88	5.42

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