

**Subjective Equilibrium Theory of the Farm Household:  
Theory Revisited and New Directions**

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## **Subjective Equilibrium of the Farm Household: Theory Revisited and New Directions**

### **Introduction**

Farm households in developed and developing countries continue to adjust to a wide range of changes, including changes in external economic conditions in agricultural and nonagricultural markets, environmental forces that influence farm and nonfarm decisions, and social structures and norms, as well as policy. Although forces that affect the farm household-firm unit vary widely across countries and regions, the subjective equilibrium theory of the farm household provides a unified theoretical framework for analyzing the expected adjustments that farm households make in response to change. The subjective equilibrium theory of the farm household therefore provides an approach for gaining insights into the response or adjustment of farm household-firm units to policy, by assessing the complex interrelationships between the alternative ‘perspectives’ of the household: production, consumption and labor allocation (Nakajima 1986).

This paper takes the view that *farms in developed countries are increasingly developing key relationships with external labor markets* through 1) off-farm employment, 2) employment of hired farm workers, or 3) simultaneous hiring in and hiring out of labor. The adoption of labor-saving technologies in the farm production sector and in home production has released labor from these forms of work (see Barkley 1990, Gardner 1992, Ahearn *et al.* 1997). Off-farm employment among farm men is common, and women have entered the external labor force in growing numbers to the point where today the majority of farm women in the U.S., for example, are employed off-farm (Findeis 2002). Further, off-farm wages for women have increased in real terms. For these reasons, labor decisions are increasingly important for understanding the responses of agricultural households to policy change. These trends have the potential to have significant influences not only on the farm household, but also on the organization and profitability of the farm itself.

This paper first reviews subjective equilibrium theory and then examines several new directions for research based on ‘modern’ theories of the household-firm unit. In addition, the paper draws upon data from a recent (2001) survey of farm households conducted in the United States. The data are based on 2,661 telephone interviews of farm women conducted across the United States in April 2001, by the Women on U.S. Farms Initiative Research Group at Penn State in collaboration with researchers at the Economic Research Service (ERS/USDA) and in conjunction with the National Agricultural Statistics Service at the U.S. Department of Agriculture (NASS/USDA).

### **The Subjective Equilibrium of the Farm Household Revisited**

Building on the earlier works of Chayanov (1923), Tanaka (1951, in Nakajima 1986), and his own works published (in Japanese) in the *Journal of Rural Economies*, Nakajima (1986) laid out the subjective equilibrium theory of the farm household. The theory extends well beyond the theory of the farm production unit where profit maximization is assumed, and integrates farm production, household consumption and labor decisions into a joint framework of farm household utility maximization.

The theory outlined by Nakajima and others and applied in a large number of empirical studies (see, for example, Singh *et al.* 1986, Hallberg *et al.* 1991, Caillavet *et al.* 1994, OECD 2001) is particularly useful for understanding farm household-firm unit decisions. It is widely recognized that farm households today depend on a portfolio of different sources of income, including income from the farm as well as income from off-farm wage or salary employment, nonfarm businesses (that may or may not be related to the farm), pensions, government transfer payments to farms (‘coupled’ and ‘decoupled’), and other forms of passive or nonlabor income, including dividends, rent, interest, social transfer payments, and other similar forms of income. For many farm households, income from the farm is only a small portion of total household income, although the accumulation of wealth from the farm may yield a long-term economic return that enhances the importance of the farming activity from the household’s perspective. The farm household approach as presented by Nakajima (1986) allows the analysis of decisions made across these alternative income sources, with explicit consideration of other issues such as a minimum subsistence

level of income. The focus is not solely on farm production and issues related to farm profitability, e.g., farm efficiency, farm labor productivity, among other related topics. What is important is the relationship between external labor markets and the farm household-firm unit.

### Farm Types

Following OECD (2001), three broad types of farms can be differentiated based on the relationship discussed above: 1) those farms that possess excess labor hired out for work outside of farming (Type I farms), 2) farms that neither hire out nor hire in labor (Type II farms), and 3) farms that hire in labor, since they require labor beyond the labor that can be supplied to the farm by the farm household (Type III farms). Subjective equilibrium theory is applicable to each of these scenarios, and the conditions affecting work decisions and income flows under each alternative can be outlined. The approach of using labor hiring in and hiring out behaviors as a focus has several advantages, since this approach serves to capture whether the farm household-firm unit is self-sufficient in labor or depends on conditions in external labor markets. Further, the overall spatial distribution of farms is likely to be, at least in part, a function of the local *availability* of off-farm employment opportunities and the *availability* of labor that can be hired to work on farms. From the perspective of changes in farm structure, these appear to be important considerations.

#### *Type I farms*

Type I farms include several possible organizations of labor resources. Type I farms can include farm household engagement in either off-farm wage or salary employment or in a nonfarm business (self-employment), or both, in addition to the farming business. On Type I farms there is excess household labor not being utilized in the farm operation or in the farm household, likely a result *in both cases* of adoption of labor-saving technologies by the farm household-firm unit

On some farms, farm family members work on the farm and yet also operate a nonfarm business, that may or may not be farm-related.<sup>1</sup> This case combines two forms of ‘self-employment’. Data from the 2001 Penn State Survey of U.S. Farm Women show that about 15 percent of all farm households in the U.S. operate at least one nonfarm business, a figure that is about the same as the percentage for Canada observed by Bollman (1994).

Graphically, the combination of two forms of self-employment is shown in Figure 1. Farming (F) initially has the highest marginal return to labor, but eventually the marginal return to labor utilized in farming is exceeded by the marginal return to labor employed in another business (N). Equilibrium occurs where the household’s indifference curve ( $I_0$ ) is tangent to the combined net returns to labor curve ( $OZ'N'$ ), i.e., at the point Q. The optimal amount of household work time is  $T_t^*$ , and the household’s time is allocated to farming  $T_f^*$  and to the alternative business  $T_n^*$ .

Leisure (Huffman’s (1991) ‘home time’) equals  $\bar{T} - T_t^*$ , where  $\bar{T}$  is the total time endowment of the farm household.<sup>2</sup> The different businesses, of which the farm is one, may be operated from the farm household-firm unit location. In the case where the farm and nonfarm business are interrelated, jointness in input-output relationships should be accounted for in estimation. There may be multiple nonfarm businesses being operated by the same household.

Alternatively, farm households may engage in farm work and off-farm wage or salary employment, another possible combination, as shown in Figure 2. Given a constant wage rate (shown by the line W in Figure 2) and the farm business net returns curve F, the farm household can be expected to allocate time initially to the farm and then to off-farm wage employment. The result is multiple job-holding both on and off the farm. Again, the equilibrium is at

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<sup>1</sup> The issue of the relationship between a nonfarm business and the farm is often raised, due to potential jointness in inputs and outputs. Some nonfarm businesses are so interrelated with the farm that viewing the two businesses separately is neither feasible nor practical. However, many farm businesses are only minimally related to the farm.

<sup>2</sup> The line  $SS'$  is the minimum subsistence level of income discussed by Nakajima (1986).

Q and  $T_t^*$  is allocated to work, with  $T_f^*$  to farm work and  $T_w^*$  to off-farm work. Off-farm work may serve, in this case, to reduce underemployment in the farm production sector (Olfert 1992).

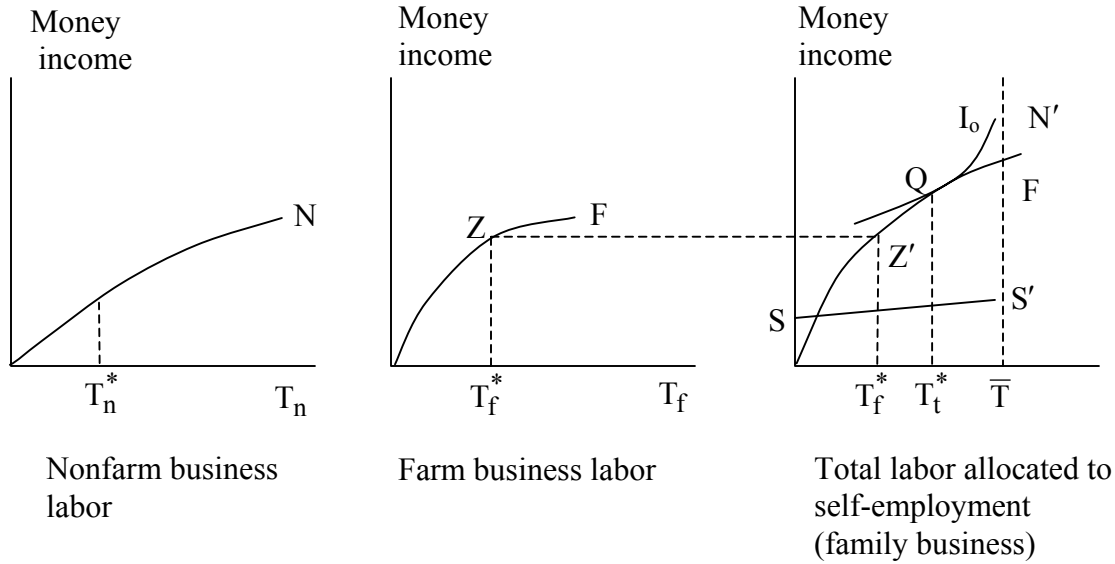


Figure 1. Subjective equilibrium with multiple self-employment choices: farm and nonfarm businesses.

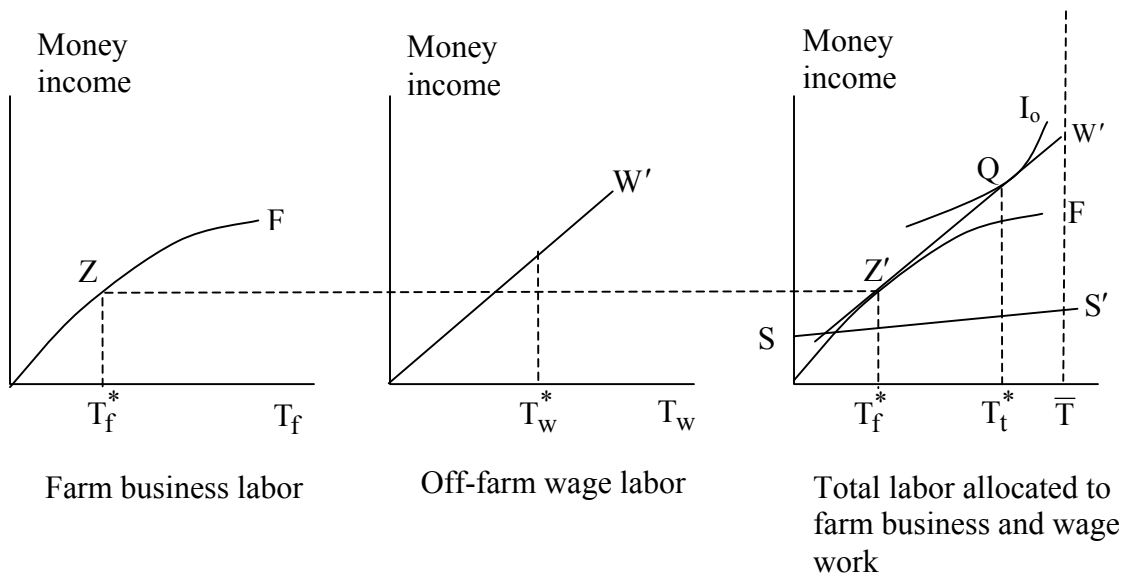


Figure 2. Subjective equilibrium with choices between the farm business and off-farm wage or salary employment.

It is also potentially the case that some families engage in all three possibilities simultaneously, i.e., off-farm wage/salary work, work in a nonfarm business, and work on the farm. In each case, the marginal returns to the work that is undertaken influences the time allocation of farm household time, that is also affected by the household's preferences for consumption versus 'leisure' or home time.

Finally, Nakajima (1986) also raises the possibility that some farm households may, in fact, work full-time off the farm, and lays out the case where off-farm work has a higher initial marginal return to labor than farming (Figure 3).<sup>3</sup> In this case, farm households allocate time to one (or more) full-time jobs, and then use the remaining work time to operate the farm. The implicit assumption is made that a second off-farm job has lower marginal returns than farming.

This case is an important possibility. Although the presence of full-time off-farm employment does not assure that time will be allocated to off-farm work 'first,' with farm work 'second,' it is quite likely that a number of farms in the United States (and possibly in other countries as well) exhibit this behavior. This matters from a policy perspective, especially in light of policy reform under CAP and 1996 FAIR in the U.S. (see OECD 2001). That is, if decoupled direct payments are considered a form of exogenous income to the farm household, then the effect of payments will be a decrease in total work time, due to the income effect. However, the 'order of work' matters. *If time is first allocated to the farm operation and then to off-farm work* (as is typically assumed, except for small farms) then the decrease in total work time will affect the time allocated to off-farm work, with less time being spent working off the farm. *But if time is first allocated to the off-farm work and then to the farm*, the effects of policy reform resulting in decoupled farm payments will be quite different, with the decline in work time affecting the farm not the off-farm work. Using the subjective equilibrium theory of the farm household-firm unit, it is possible to show that the effects of policy reform will vary, depending on the assumed 'order of work'.

#### *Type II farms*

Type II farms are self-sufficient in labor and neither hire out nor hire in labor. Work time is *entirely* allocated to the farm operation, with no jobs 'on the side'. At least two possibilities exist. First, on Type II farms, all household labor may be used to support the farm because the farm yields higher marginal returns than either a nonfarm business or an off-farm job, over the entire range of time allocated to work. Farming is either quite profitable, or off-farm jobs and nonfarm businesses pay particularly low returns to labor, or both. The choice is to work entirely on the farm.

Type II farms where this situation is characteristic may be located either in rural or urban areas. In some rural areas, and particularly in remote rural regions, off-farm jobs may not be locally accessible, resulting in all work time being allocated to the farm operation (or to 'home time'), with likely underemployment of labor resources on the farm. The possibility also exists that the local off-farm wage is so low that it fails to exceed the reservation wage, and farm household members may choose to allocate time to 'home time', when in other labor markets they would work off-farm. Finally, the transactions costs associated with working (e.g., the cost of working off the farm including the cost of travel to and from off-farm work and the time spent in travel) may also influence work choices. In remote rural regions, transaction costs associated with off-farm work can be high.

#### *Type III farms*

Finally, Type III farms are those that hire in labor, i.e., those needing labor beyond that which can be supplied by the farm household. Hired-in labor may be employed year-round or on a seasonal basis when farm labor requirements are high. In either case, the farm household's preferences are to hire in labor (at a wage  $W_h$ ) to supplement farm household labor. This possibility is shown in Figure 4, where  $F_f^*$  is the total labor time (both family and hired) allocated to farming, with the labor input divided between farm household time allocated to the farm ( $T_f^*$ ) and

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<sup>3</sup> Killingsworth (1983) also discusses the implications of certain labor rationing conditions.

hired-farm labor ( $F_f^* - T_f^*$ ). As shown in Figure 4, household work time that would have been allocated to the farm is now 'freed up' by the hiring in of farm labor and can be utilized for another purpose, i.e., leisure or home time, or perhaps in another business or off-farm employment.

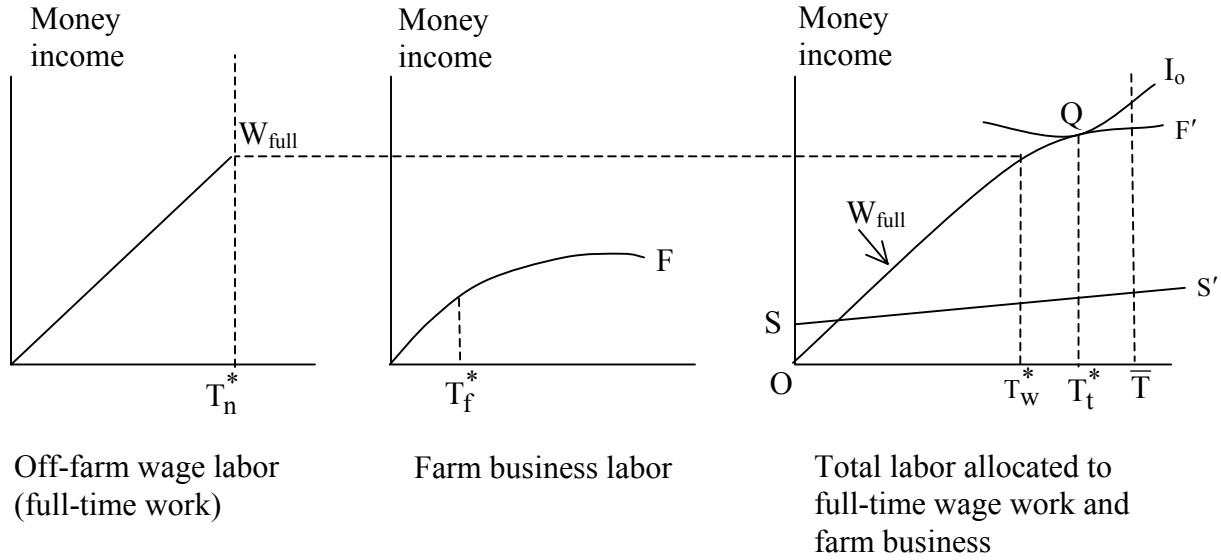


Figure 3. Subjective equilibrium with full-time off-farm wage employment.

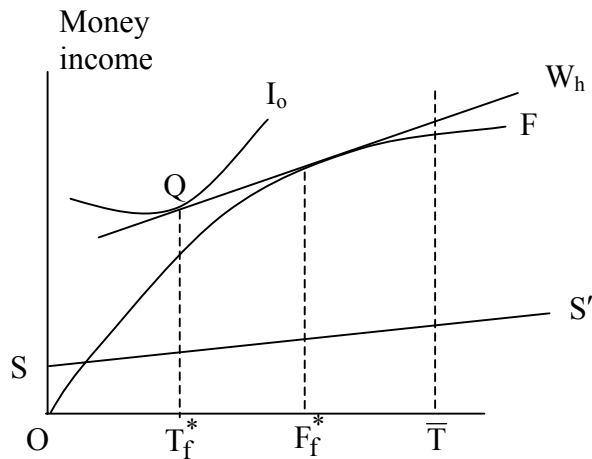


Figure 4. Allocation of household work time with the hiring-in of supplemental labor.

Some farms also both hire in and hire out labor (see Findeis and Lass 1992). Sadoulet *et al.* (1998) argue that this behavior is economically rational and can be attributed to the existence of wage ‘wedges’ that separate the wages of family farm managers from those paid for hired farm labor. This result is that farm household labor may be hired at higher wages in the off-farm labor market while lower-wage workers are hired for farm work. The Penn State Survey of U.S. Farm Women shows that this behavior is surprisingly prevalent on U.S. farms, with about 30 percent of surveyed households simultaneously hiring in and hiring out labor.<sup>4</sup>

### Factors Affecting the Subjective Equilibrium

Each farm ‘type’ may be affected by changes in factors expected to influence the subjective equilibrium. In some cases, farm households adjust their intensity of use of household labor or hired farm labor, in response to changes in factors known to influence these decisions. In other cases, farms may ‘switch’ between farm types — for example, with farm households that had previously not worked off the farm now taking up off-farm employment (Type II farm becomes Type I), or farm households that were previously operating a nonfarm business giving it up in response to increases in farm profitability (Type I farm becomes Type II).

Examples of factors expected to influence the subjective equilibrium include changes in farm profitability due to increases in product prices, decreases in the prices of factors of production (lower input prices), or changes in policy that lead to higher marginal returns to labor allocated to farming; increases in the off-farm wage rate; changes in exogenous income (e.g., dividends, rent, interest, government transfer payments unrelated to work effort); and changes in nonland assets and land, and other fixed factors of production. Table 1 outlines some of the potential changes that likely result in adjustments in work time between different sources of income, and between work and leisure.

Changes in policy can be expected to cause labor adjustments, influencing the distribution of farms between the three different farm types. Price supports can be expected to affect work decisions similar to the effects of higher product prices, i.e., enhancing the profitability of agriculture. In the short run at least, more farm household time can be expected to be allocated to the farm operation. Alternatively, minimum wage legislation increasing the minimum wage paid for nonfarm work can affect the returns to off-farm employment, at least for some workers. Finally, (fully) decoupled direct payments are expected to influence the total time worked by the household. The effect *on the total household* depends on the marginal returns to labor off the farm versus in farming, as previously discussed.

### New Directions

#### 1. Considering the Effects of Off-farm Work on the Farm Operation

In general, the majority of models presented in the literature have assumed that time allocated to off-farm work has a lower marginal return (initially) than farm work (the model in Figure 2). That is, the time allocated to on-farm versus off-farm work is determined by the marginal conditions between on-farm and off-farm work, but work time on the farm is assumed to have the highest initial return to labor time. Both Arayama (1985, 1986) and Nandkeolyar (1991) question this approach, arguing that at least some farm households (in Japan and in Pennsylvania) have a higher initial marginal return to labor allocation off the farm. The Arayama and Nandkeolyar studies in many respects take the approach of Nakajima (1986) that argues that at least some farm households (and perhaps more importantly, individuals within these households) allocate time to full-time off-farm work initially and then to farm work. Of course, issues of farmer preferences for on-farm versus off-farm work come into play here, and several studies have shown that farm operators generally prefer to work on their own farms in comparison to working in an off-farm wage job (see Weiss 1997, Corsi and Findeis 2000).

The result of the view that farming has the higher initial marginal return is that many studies in developed countries

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<sup>4</sup> The hiring in and hiring out of labor occurred within a year. It is possible that there is not exact simultaneity, and that hiring in and hiring out occurred in different seasons.

Table 1. Potential Effects of Changes in Parameters of the Subjective Equilibrium of the Farm Household

Change

*Product price (farm)*

Increases in the output price received for farm products can be expected to increase work time allocated to the farm, with less time allocated to nonfarm businesses and off-farm wage employment. Relative effects, however, will be influenced by the income effect; increases may negatively influence total work time.

*Factor prices (farm)*

Increases in prices paid for farm inputs can be expected to result in declines in time allocated to farming, with increases in the time allocated to nonfarm businesses and off-farm work.

*Product price (nonfarm business)*

Increases in the price of nonfarm business products are expected to increase work time allocated to the nonfarm business, with the extent of total work time (and therefore the allocation to other forms of work) depending on the response to the increase in income. The response will also depend on whether the products produced by the nonfarm business and the farm are interrelated, implying jointness in labor decisions.

*Factor prices (nonfarm business)*

Increases in prices paid for nonfarm business inputs are expected to reduce the time allocated to the nonfarm business.

*Land use*

If farm land area increases, the expectation is an increase in farm production. The likely effect is an increase in the marginal returns to farm work, resulting in more time allocated to farming. The impacts on time allocation will also depend on the income effect.

*Exogenous income*

Increases in exogenous income (e.g., dividends, interest, rent, and some forms of transfer payments) will reduce total work time.

*Off-farm wage*

Increases in the off-farm (external) wage will 'pull' labor off the farm into the off-farm labor market. The expected result is more off-farm work and less self-employment (farm and nonfarm), to the extent that the marginal returns to off-farm work exceed the marginal returns to self-employment. Again, the total work time will depend on the extent to which income increases, resulting in changes in leisure.

*Price support policies*

The effects of farm price supports are similar to changes in product prices. Price supports enhance product prices, with the effects similar to those outlined above for increases in product prices.

*Direct payment policies*

If direct payments are fully decoupled, direct payments will have the same effect as increases in exogenous income.

have considered the agricultural household model as a separable one, with farm decisions made first followed by the household's utility maximization problem. If separability is not assumed *a priori*, then the very real possibility presents itself that off-farm employment can affect the organization of the farm operation. That is, off-farm employment and the organization of the farm enterprise are jointly determined in a nonseparable way, not in the recursive or separable way that most have assumed.<sup>5</sup> If this is the case, then it is possible that off-farm employment will affect farm efficiency, for example, or influence enterprise choice or environmental decisions, or any number of different farm decisions.

Some studies of farm production have included off-farm employment or income as an exogenous variable in the models being estimated. However, these studies have assumed that off-farm choices are exogenous, which is not the case in the Nakajima model, regardless of in which 'order' the farm work vs. off-farm work occurs. The correct approach is to assume that off-farm and on-farm decisions are endogenous — i.e., both are choice variables. Thus, off-farm work participation, off-farm labor supply and off-farm income should be modeled in such a way as to recognize their endogeneity with decisions that affect the farm operation.

The recognition that the subjective equilibrium is more appropriate, particularly for analyzing the effects of policy reform, should encourage new research that considers off-farm and nonfarm business decisions as endogeneous, with potential implications for the farm organization.

## 2. Disentangling the Household: The Relevance of Disaggregated Data

Many countries continue to focus their survey efforts on the farm or the farm operator, without consideration of the entire household. Farm surveys that focus on the farm itself and on the responses of one main farm operator have two principal weaknesses. First, such data provide only a partial assessment of the income position of the farm household, and likely miss the other work that takes place within the household that may generate significant income support. And second, this approach fails to include the important interrelationships that might exist between alternative sources of income — i.e., assuming that the farm and nonfarm enterprises are separable may ignore important interactions, such as the use of income from off-farm employment for farm investment or to secure farm loans, or the use of farm losses to offset taxes owed by another business operated by the household.

Many studies today explicitly consider differences in behavior by adult males and females within the household and may even consider the work contributions of children separately (often disaggregated by gender). In developed countries, estimated models have generally used a disaggregation of data by the farm husband and wife, or perhaps by farm operator and farm spouse (roughly assumed to be nearly the same as the husband/wife model) (see, for example, Lass *et al.* 1989, Huffman and Lange 1989, Tokle and Huffman 1991, Huffman 1991, Bryden *et al.* 1992, Lass and Gempeasaw 1992, Corsi and Findeis 2000). The explicit consideration of children is more likely to be observed in models of agricultural households in developing countries, in part due to the importance of child labor to developing country farm households and due to interest in schooling-work trade-offs (see Becker 1981, Behrman *et al.* 1993, Mukhopadhyay 1994).

Disaggregation of the adjustment effects by gender in the household serves to provide a better understanding of the effects of economic and social change and the impacts of policy (Schultz 1999). Consideration of the multiple activities of individuals that comprise the household unit allows not only ways to explain time allocation differences across individuals but also (importantly) allows the explicit consideration of the multiple income sources that serve to support the farm household-firm unit.

### *An empirical example: farm women in the United States*

Data from the Penn State Survey of U.S. Farm Women support the view that there are important changes occurring in farm households, particularly with respect to the work roles of farm women. For example, in 1980 when

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<sup>5</sup> There are really two different but interrelated issues here: 1) separability versus nonseparability, and 2) the 'order of work' choices, even when work decisions are jointly made based on the marginal conditions.

Rosenfeld (1985) conducted the last major survey of farm women in the United States, 37 percent of farm women had worked at an off-farm wage or salary job. In the 2001 survey, 52 percent of all farm women had worked at an off-farm job in the previous year and 62 percent of working-age women had done so.<sup>6</sup>

The changes in participation in off-farm work among women on U.S. farms are significant. Further, the off-farm income contributions of women have increased, due to both higher participation rates of farm women in external labor markets and to the higher real wages earned by women today. Many farm women in the United States now hold jobs that supply them with employee benefits, that benefit the farm household in both the short term (health benefits) and long term (pension or retirement benefits). The Penn State survey found that 59.7 percent of farm women that worked off-farm received health insurance through their employers, 52.8 percent received life insurance, and 55.4 percent received a pension as a benefit of their employment in an off-farm job. When asked *why* they worked off-farm, over half of the farm women noted that receiving benefits was *an important reason* for their off-farm work; i.e., those receiving job benefits reported viewing benefit receipt as a very important reason for their work.

The 2001 survey also shows that farm women have different views of their roles on the farm than is often assumed by data collection efforts and research focused at the household level. When asked if they are ‘the main operator or one of the main operators of the farm or ranch’, 53 percent of the farm women participating in the 2001 survey responded ‘yes’. In total, about half of all women who participated in the survey self-classified themselves into a ‘high involvement’ role on the farm — as a principal farm operator (10 percent), full agricultural partner (31 percent), or farm business manager (7 percent). Further, women’s roles in farm decision-making appear to be changing, with more women now participating in making decisions (either alone or jointly) regarding purchases of major farm equipment, what products to produce and the use of new innovative technologies on the farm, and how farm products are marketed. Interrelationships between the farm and off-farm work decisions can also be observed: about one in three farm women in the United States reported that working to provide money for the farm operation is an important reason that they have off-farm work.

The ‘disentangling’ of trends affecting individuals within households has potential for providing a better understanding of intrahousehold adjustments. For example, policy reform may differentially affect farm men and women, due to gender differences in marginal productivities, the ‘order of work’, and reservation wages.

#### *Alternative theories: cooperative versus noncooperative bargaining models*

Related to the recognition that intrahousehold interactions are potentially important, at least two bodies of literature are developing, to enhance knowledge of farm household behavior and the interrelationships between individuals comprising the farm household-firm unit. Both bodies of literature use game theory to further ‘disentangle’ household relationships. They include: 1) the application of bargaining models to assess the interactions (‘bargaining’) between men and women in the farm household, and 2) the use of bargaining models applied to the issue of intergenerational relationships and transfer of the farm. Recent advances have not only focused on disaggregating household data but also on understanding how differences in preferences affect the decisions that are made within the household — i.e., how the subjective equilibrium changes when different assumptions about household behavior are made.

In the early 1980s, Manser and Brown (1980) and McElroy and Horney (1981) questioned the unified household model approach found in much of the literature, and proposed models based on bargaining behavior. The unified model of households assumes that the household acts as a single decision-making unit, maximizing the utility of the entire household unit. An aggregate household utility function is assumed. Income earned by individual household members is pooled, and the household unit makes decisions jointly — for factor demand, labor supply, consumption levels, and all other production-consumption decision made by the household unit. The unified model moves away from the even earlier ‘benevolent household head’ model by assuming that all individuals in the household are involved in joint decision-making. The initial bargaining models assumed that individuals in the household possess

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<sup>6</sup> Working-age is defined as including those 18 through 64 years of age, inclusive.

their own preferences that might differ. Therefore, the household's decisions might reflect a bargaining process between individual household members.

The early bargaining models posited that individuals in households likely make decisions over some aspects of the household alone but make others jointly as a unit, with their 'say' being influenced by those factors that affect their threat points and bargaining power. Consumption goods were believed to have two components: a set of 'public goods' that are decided upon by the household jointly using pooled resources and a set of 'private goods' that are decided upon by the individuals themselves. Each individual is assumed to decide on his or her own leisure time. Decisions were assumed to take place in a Nash-bargained household decision framework, with each individual's threat point being the utility gained by the individual if they left the household (McElroy 1990). The model includes both shared and nonshared components (see Lundberg *et al.* 1997).

This model, now known as the cooperative bargaining model, has received considerable attention in the literature and has been applied in a number of contexts to understand the decisions that households make. The differentiation of 'spheres' between men and women in the household has been argued by some (e.g., Lundberg and Pollak 1993), as a way in which the model plays out within the household when agreement cannot be reached. As a result, the public goods provided within the household may well have gender and age-differentiated characteristics, that reflect gender and age roles. Further, there is likely to be a dynamic aspect to the decisions — with decisions made in an initial time period affecting future decisions (Ott 1995, in Doss 1996). In the cooperative model, factors that influence the threat point also influence the decisions made within the household. Therefore, as individuals within the household are faced with the possibilities of contributing more income or additional assets to the household, the implication is a change in the threat point. Changes in the threat point are expected to influence the allocation of resources within the household as well as work choices.

Some recent studies have taken a different approach, i.e., the noncooperative bargaining model approach. The noncooperative models are based on the key assumption that income is not pooled in the household and that individuals make decisions based on their own individual preferences and their individual access to resources. The bargaining that occurs in this model determines the allocation of resources to *both* the private and public goods of the household (Doss 1996). The model is believed to be most applicable to households (e.g., polygamous households) where income is not pooled — the male household head allocates his income and the wives each maintain their own incomes to use for their individual households. The noncooperative model diverges to a greater extent from the unified model than the cooperative bargaining model, since each individual is assumed to maximize his or her own utility, based on his or her own preferences.

#### *Empirical applications to farm households*

The models described above have been applied in the economics literature, and have received considerable attention in the literature on agricultural households in developing countries. However, there have been few studies of bargaining by men and women in farm households in *developed* countries. Findeis and Swaminathan (2002) suggest that farm decision-making is influenced by gender differences in bargaining power that are a function of the line of succession of the farm through his or her family. His or her human capital appear to be less important in farm decision-making, although human capital variables strongly influence work choices on versus off the farm.

Lundberg and Ward-Batts (2002) argue that household outcomes can be in part explained by consideration of the household as an entire unit, but that the power of models improve as differences by gender are considered, and have the potential to improve even further as intrahousehold bargaining relationships are analyzed. It is in this line of thought that the bargaining models fit — if household power positions can be better explained both theoretically and then empirically, the ability to 'predict' outcomes will likely improve.

Bargaining can also be applied to the problem of intergenerational transfers, i.e., from parents to succeeding generations (see Rangel 2000). For farm families, either inheriting or purchasing the farm from a family member is an important issue; the majority of farms participating in the Penn State Survey of U.S. Farm Women were passed down to succeeding generations either through purchase from a relative or gifting. From a policy perspective, the

conditions under which farms pass from one generation to the next is a key concern, given the potential effects of inheritance taxation on farm households and farms.

Research has recently focused on the issue of intergenerational succession in agricultural households (see, for example, Kimhi 1994, Phimister 1994, Pesquin *et al.* 1999, Kimhi and Nachlieli 2001). In the bargaining models, parents are viewed as offering rights to the farm to their children in return for old-age security (through continuing to live on the farm with the aid of their children). Children are then viewed as receiving productive farm assets in return for providing for their parents. Typically, both parents and children live on the farm as adults, during the period of 'transfer'. More research using such approaches have merit in terms of understanding the process of farm transfer. Given the aging of the farm population, this issue probably deserves even more research attention.

### 3. The New Behavioral Economics

Finally, a potentially important field of study related to the subjective equilibrium theory outlined by Nakajima (1986) is the New Behavioral Economics, an approach that combines thought from economics, sociology and anthropology (see discussion in Mullainathan and Thaler 2000). When analyzing household behaviors and decision-making, economic incentives are often shown to be important but may fall short of fully explaining the full range of outcomes that are of interest, either from a research or policy perspective.

At this point, this approach has not become integrated into the household model, although research on agricultural households has in general implicitly considered the possible contributions of both sociology and anthropology to the understanding of household behaviors. A better integration of the theories and empirical findings of these three disciplines would further enhance understanding of the subjective equilibrium as it plays out in households engaged in agriculture in a wide variety of contexts.

### Conclusions

The subjective equilibrium theory of the farm household-firm unit has provided a unified framework that has served to explain the many changes that have occurred in the farm sector and on farms in both developing and developed countries. Relatively few farm household-firm units in developed countries today are independent of external labor markets that can influence the returns to farm household labor allocated to employment outside of farming and the costs of hiring labor for farm work. Instead, most farm households are engaged in multiple job-holding and/or dual job-holding, and depend on both farm and nonfarm income. Given the trend toward more dependence on off-farm employment and income even among farm households that operate large and medium-size farms, this trend has implications for a wide range of farms and is no longer limited to small farms.

New approaches to understanding differences that occur within households and the dynamics of household interactions are receiving increased attention. Research has sought to disaggregate or 'disentangle' the farm household, and recent studies have attempted to use bargaining models to extend this understanding to household decisions that cannot be fully explained outside of a game theoretic framework. Understanding how farm households are affected by and respond to policy reform is likely to be best understood when the multiple dimensions of farm households are explicitly considered.

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