

Lecture XVII: Allen & Lueck – The Nature of the Farm

Charles B. Moss

October 15, 2013

Readings for next time

Current Organization of the Farm Sector

A Model of Farm Organization

Structure of Ownership

Partnership

Readings for next time

- ▶ Moss, Charles B. 2013. Knowing the Value of Coffee: Institutional Design and the Value of Information. Food and Resource Economics Department, Working Paper.

Introduction - Current Organization of the Farm Sector

- ▶ "In 1989 corporations made up 18.5 percent of all nonfarm businesses, but generated 90 percent of all nonfarm business receipts."
- ▶ "The 1992 U.S. Census of Agriculture shows that more than 85 percent of farms are organized as 'family farms.'"
 - ▶ "Excluding small family-held corporations, farm corporations made up only 0.4 percent of all farms in 1992, 1.3 percent of all farm acreage, and generated only 6 percent of all sales receipts."
 - ▶ This decline has occurred despite radical changes in the size of farms – "farm numbers have declined, farm size has increased, and technological changes have converted farms into capital-intense enterprises."

- ▶ "Using a model that examines the trade-off between moral hazard incentives and gains from specialization, we focus on two dimensions of farm organization, the choice of farm ownership and the extent of farm control over successive stages of production."
- ▶ "Understanding farm organization requires marrying the modern theory of the firm to the seasonal constraints placed on production by nature."
 - ▶ Seasonality is the main feature that distinguishes farm organization from 'industrial' organization.
 - ▶ Agricultural economists have long recognized this point....
 - ▶ Until now, however, agricultural economists have not connected their insights regarding seasonal production stages, crop cycles, task specialization, and random events to modern theories of the firm."

- ▶ In this model extending the firm using outside equity reduces the cost of production, but increases the cost of labor. This tradeoff is increased by the impact of seasonality.
- ▶ "The simplest family farm avoids the moral hazard because the farmer is the complete residual claimant."

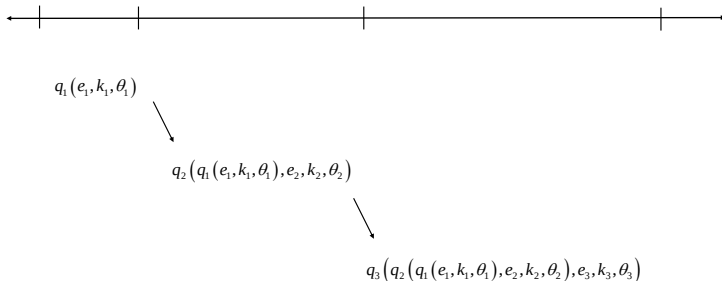
A Model of Farm Organization

- ▶ The basic model of the farm is a sequence of activities – soil preparation, planting, scouting for insects, harvesting, storage and sales. This sequence of activities could be accomplished by a single firm (i.e., a family farm) or a sequence of contracted firms.
- ▶ "To uncover these features [the effect of seasonality], we model seasonality as a collection of paramters:
 - a. C , the number of times per year the entire production cycle can be completed;
 - b. S , the number of stages in the process;
 - c. T , the total number of tasks in a given stage; and
 - d. L , the length of each stage."

- Production is then a sequence of production activities. Later production activities are dependent on preceding production activities. Each activity involves some level of effort e_i , capital k_i , and a random outcome θ_i

$$\begin{aligned} & q_1(e_1, k_1, \theta_1) \\ & q_2(q_1(e_1, k_1, \theta_1), e_2, k_2, \theta_2) \end{aligned} \tag{1}$$

Production Sequence



- ▶ A simplified form is developed by Allen and Lueck

$$q_s = h_s(e_s, k_s; q_{s-1}) + \theta_s. \quad (2)$$

- ▶ The central part of the model then involves the labor constraints – a subdivision of effort $e_s \rightarrow t_{stn}$ where s is the stage, t is the number tasks in a given stage ($t = 1, \dots, T$), and n is a particular worker. The effort at a given stage is then broken down into
 1. $e_s = a_s t_s$ where e_s is the total effort,
 2. $a_s = (N_s L_s / T_s)^{\alpha_s}$ is a measure of the gain to specialization, and
 3. $t_{st} = \sum_{n=1}^N t_{stn}$ is the total amount of time from each laborer.

- Thus, for a given stage of production

$$q_s = h_s(a_s t_{s1}, \dots, a_s t_{sT}, k_s; q_{s-1}(d)) + \theta_s \quad s = 1, \dots, S \quad (3)$$

The Structure of Farm Ownership

- ▶ In general, we assume that the cost of capital is a decreasing function of the number of owners $r = r(N)$. The maximum cost of capital comes for the family farm $r(N = 1) = r^{max}$.
- ▶ Starting with the simple model, consider a single stage of production.
- ▶ The problem facing the family farm is then

$$\max_{t_1, \dots, t_T, m, k} \Pi = h \left(\left[\frac{1}{T} \right]^\alpha t_1, \dots, \left[\frac{1}{T} \right]^\alpha t_T, k; q_{-1}(d) \right) - r^{max} k + wm$$

$$\text{s.t. } \sum_{t=1}^T t_t + m = L = 1.$$

(4)

where $a_t = (1/T)^\alpha$ since $N = 1$.

- The first-order conditions are then

$$\left[\frac{1}{T} \right]^{\alpha} \frac{\partial h \left(t_t^F, m^F, k^F \right)}{\partial t_j} \equiv w, \quad t = 1, \dots, T \quad (5)$$
$$\frac{\partial h \left(t_t^F, m^F, k^F \right)}{\partial k} \equiv r^{max}$$

- "Since the family farmer is the complete residual claimant in both activities, there is no moral hazard for task effort."
- "The family farm is, however, hindered by a lack of specialization, which reduces the marginal product of labor in every given task, as long as there is more than one task ($T > 1$)."

► Continued

- "In addition, although family farms equate marginal costs and benefits for capital, they face larger costs for capital compared with partnerships or corporations and therefore use less capital, implying a smaller farm with less equipment compared with partnership and factory-corporate farms."

Partnership

- ▶ In this scenario we assume N partners ($n = 1, \dots, N$) each supplying T/N of the required labor.
- ▶ As a starting point assume that each partner maximizes his own profit

$$\max_{t_{1n}, \dots, t_{(T/N)n}, m} \pi_n^P = \left[\frac{1}{N} \right] h \left(\left(\frac{N}{T} \right)^\alpha t_{tn}; \bar{k}, q_{-1}(d) \right) + w_n m_n, \quad n = 1, \dots, N$$

$$\text{s.t. } \sum_{i=1}^{T/N} t_{tn} + m_n = L = 1$$
(6)

where $\bar{k}$ is fixed.

- ▶ "Each partner takes $\bar{t}_m$, the task effort of all other partners for the remaining $T(N - 1/N)$ tasks as given."
- ▶ "The optimal task effort vector

$$t_m^P(\Phi) = t_{tn}^P(N, T, \alpha, w, L, \bar{t}_{tn}, k, q_{-1}(d)), \quad (7)$$

solve the following first-order necessary conditions

$$\left(\frac{N^{\alpha-1}}{T^\alpha}\right) \frac{\partial h(t_{tn}^P(\Phi))}{\partial t_m} \equiv w_n, \quad t = 1, \dots, T/N \quad n = 1, \dots, N. \quad (8)$$

Equation [8] shows that the number of partners does not affect the marginal rate of substitution between tasks on the farm but does affect the amount of a partner's effort on the farm."

- ▶ Comparing incentive compatibility (*IC*) and individual rationality (*IR*) – assuming individuals have equal endowments, the effective effort time for each task is $(N/T)^\alpha t$. Each partner earns the same off-farm income

$$wm = w \left[1 - \sum_{t=1}^T t_t \right]$$

$$\max_{k,N} \Pi^P = h \left(\left(\frac{N}{T} \right)^\alpha t_t, k; q_{-1}(d) \right) - r(N)k + Nw \left[1 - \sum_{t=1}^T t_t \right],$$

$$\text{s.t } (IC) \rightarrow t_t = t_t^P(\Phi) = \operatorname{argmax} \pi_t^P, t = 1, \dots, T$$

$$(IR) \rightarrow \pi_t^P \geq \bar{V}$$

(9)