Journal of Agricultural and Applied Economics, 36,3(December 2004):575–590

An Evaluation of U.S. Hog Producer Preferences Toward Autonomy

Jeffrey M. Gillespie, Christopher G. Davis, and Noro C. Rahelizatovo

Hog farmers' preferences for autonomy are assessed through the use of eight questions dealing with their preferences for general decision making and with respect to specific management actions. Farmers generally preferred to make a higher percentage of the decisions about their operations, especially older producers and those who operated farrowing units. Farmers who placed lower values on autonomy finished hogs, were nearing retirement, valued social relationships with other farmers more highly, had higher off-farm income, or were larger farmers.

Key Words: Autonomy, contracting, pork production, utility

JEL Classifications: Q12, L14, D21

Although the evolution of the U.S. agricultural sector toward increased contracting has arguably led to increased firm expansion and risk-management opportunities, it has largely reduced the managerial control that many farmers have over their operations. Although such concerns have been the source of much discussion among farmers, industry leaders, and academics, little research has examined farmers' attitudes toward the increased control that firms up- or downstream from the farm have over everyday production decisions.

In recent years, the U.S. hog industry has continued to evolve to a structure that includes an increased portion of contract, relative to independent, farmers. The typical contract involves the contractor furnishing contractor-owned feed, animals, supplies, and some management, while the farmer furnishes labor, facilities, equipment, and land for hog production. The farmer is paid a previously-agreed-on payment for hogs and, sometimes, incentive payments for production efficiency. Thus, some input use, as well as marketing, is determined by the contractor. By 1997, as many as 44% of the hogs finished were produced under contract (Lawrence, Grimes, and Hayenga). The industry is following a path similar to that taken by the broiler industry 40 years ago, which led to virtually 100% of U.S. broilers being produced under contract. As higher percentages of product in a number of agricultural segments continue to be produced under contract or under joint ownership with another firm, it is, from a policy perspective, of importance to understand the types of farmers whose utility is likely to be greatly affected with the prospect of lower autonomy. After all, such changes shift agriculture away from some of the ideals summarized in 1964 by

Jeffrey M. Gillespie is associate professor, Department of Agricultural Economics and Agribusiness, Louisiana State University, Baton Rouge, LA. Christopher G. Davis is economist, Economic Research Service, U.S. Department of Agriculture, Washington, DC. Noro C. Rahelizatovo is a former graduate research assistant, Department of Agricultural Economics and Agribusiness, Louisiana State University, Baton Rouge, LA.

The authors acknowledge partial funding secured through the National Pork Board.

Paarlberg as the Agricultural Creed, specifically including (1) The land should be owned by the person who tills it, and (2) A farmer should be his/her own boss.

Perhaps the first definition of autonomy in the context of the selection of business arrangements in agriculture was provided by Gillespie and Eidman: "the desirability of a business arrangement on the basis of how business structure and lifestyle aspects other than income and variability of income are affected." The subattributes of autonomy included the following factors dealing with the contractor's level of control: the possibility of a broken contract, shared management responsibilities, contractor determination of input usage, contractor determination of how much and when to produce, and contractor ownership of assets. In the present study, we focus on the farmer's preferred level of control over the operation. Examined are the importance the farmer places on autonomy, the types of farmers who place greater values on autonomy, and the specific aspects of the operation over which the farmer prefers to have control.

Autonomy is one of a set of attributes that comprise a farmer's utility function when determining which of a number of potential business arrangements to choose. Such business arrangements may include independent production, various types of contracts, membership in a marketing cooperative, or others. The decision-making process may be modeled in a multiattribute utility framework as $U = u(a_1, a_2, \ldots, a_n)$, where U is utility and a_i represents attribute i. Keeney and Raiffa are among the economists who have formalized the multiattribute utility framework. An attribute other than autonomy that is generally considered to be important to the decision process and that has been examined exclusively in most agricultural business arrangement decision studies is net income. Subattributes of net income may arguably include factors such as transaction costs, risk, economic considerations with respect to asset fixity and other economic factors that might influence business arrangement selection. The present study does not focus on income risk but rather exclusively on the preference for autonomy.

How important is autonomy to U.S. hog producers? Most economists who have worked in the hog or broiler industries are aware of the controversy among farmers regarding contracting. Perhaps the most frequently heard complaint regarding contracting is the loss of control over the operation and the resultant employee status, compared with the independent small-business operator. Some farmers selected farming as an occupation for its independent nature of production. Previous research has shown the importance of independence to farmers. For instance, "Be My Own Boss" was the top rated of five goals in a goal hierarchy study conducted by Kliebenstein et al. This goal was rated as more important than "Increase Farm Income." These results are consistent with results of Gillespie and Eidman with regard to independent hog producers.

The loss of autonomy has had a significant impact on public policy and vice versa. Fear of loss of autonomy has arguably contributed to the introduction of anticorporate farming laws in a number of states; much of this legislation attempts to prevent packers from owning livestock, in the hope that independent producers may remain viable. The threat of loss of autonomy has led to significant opposition to contracting in some regions, especially the traditional hog-producing Midwestern states. This opposition to contracting has been one of a number of factors contributing to the shift of the industry to regions of the U.S. that have traditionally had limited hog production.

The loss of autonomy has been influenced by and continues to influence industrial organization. Today's hog producer is faced with the decision of whether to remain independent, with full autonomy; to cooperate with other producers in such a way as to compete with the quasi vertical integrators; or to contract with a vertical coordinator. Numerous examples of reactions by farmers to industrialization are found in the academic and popular presses. Examples include Grey, who documented the formation of a hog production cooperative that produces free-range pork for distribution in niche markets, and Fulton and

Gillespie, who documented the introduction of alternative cooperative organizations.

The questions we address in this study are: How much importance do hog farmers place on autonomy? Do some hog farmers place greater importance on autonomy than others, and if so, which ones? What are the implications for the U.S. hog industry? Because of the importance of obtaining a relatively large cross-section of responses and, hence, the infeasibility of utilizing personal interviews, we did not quantify the value of autonomy, as was done by Gillespie and Eidman with a smaller sample, but instead relied on responses to discrete choice questions in a mail survey.

Previous Research

A number of economists have examined the selection of business arrangements on the basis of a single attribute, typically income risk (e.g., Johnson and Foster). We are aware of only one published study in agricultural economics literature that has included autonomy as an additional attribute. Gillespie and Eidman found that autonomy was at least as important as income and associated risk in independent hog farmers' contracting decisions. In that study, Minnesota hog farmers' preferences were elicited via personal interviews. The autonomy premium was determined as the difference between the contract premium and the risk premium, thus attributing all considerations for business arrangement selection other than income risk to autonomy. The present study differs in that (1) autonomy preference was elicited directly via questionnaires over a larger sample of farmers rather than derived indirectly, (2) various subattributes of autonomy were examined, and (3) preferences of contract producers were examined.

Several studies in the psychology and business literature dealing with autonomy are noteworthy. Many of these studies—such as Eden, Katz, and Weaver and Franz—compared the well-being of self-employed persons with wage or salary earners. Among the earlier studies, Eden found that self-employed persons were generally more satisfied with their jobs than were wage or salary earners. Furthermore, the benefits of self-employment were much lower when controlling for autonomy.

Vandenheuvel and Wooden examined differences in job satisfaction among salaried or wage earners, self-employed contractors, and other self-employed individuals. They found that independent contractors were more satisfied with their employment than were individuals in the other groups. They stated, "The most likely explanation for this difference is the greater freedom and autonomy such workers have in their working lives compared with the dependent contractors."

Hundley examined the factors that contribute to the greater satisfaction of self-employed workers with their jobs. He examined the effects of autonomy, task variety, flexibility of work schedule, skill utilization, perceived availability of alternative employment, perceived job security, and job type on job satisfaction. Autonomy dominated the other factors in explaining the greater job satisfaction reported by self-employed individuals.

Kaufmann examined the differences in individuals who opened or bought independent businesses, purchased a franchise, or remained employed by others. Franchise purchasers (who are analogous to contract farmers in many respects) placed greater emphasis on the financial benefits of franchising and were less likely to have had previous experience in the business in which they were operating. Our study differs in scope from this and similar studies in that we focused on factors influencing autonomy preference rather than examining differences in individuals under alternative business arrangements.

Overall, a common theme among most of the studies examining self-employment versus employed status is that self-employment is generally preferred and that autonomy is a major factor in explaining this preference. The increase of contracting in agriculture represents a step in the direction away from self-employment and toward employed status. Although most contract producers remain self-employed, they typically no longer are sole managers of their operations, their wages

are generally paid by the contractor, and their businesses resemble that of a franchisee.

Data and Methods

Hog farmer preferences for autonomy were collected via a mail survey administered during August–September 2000. Surveys were sent to 4,986 U.S. hog farmers to determine their production practices, selection of business arrangements, and attitudes toward structural changes in the hog industry. Dillman was used as a guide for designing and implementing the survey, with a first mail-out including the survey form, a follow-up postcard reminder, and then a second follow-up with a second copy of the survey. The list of farmers was obtained from *National Hog Farmer* magazine. Equal numbers of farmers (831 in each) in the following six annual hog sales categories of farmers were surveyed: 200–999, 1,000–1,999, 2,000–2,999, 3,000–4,999, 5,000–9,999 and 10,000 or more hogs. Producers with fewer than 200 hogs were not surveyed because of the hog operation's likely being more of a sideline rather than a major enterprise for the producer. Surveys were received from 1,031 farmers, for a return rate of just over 20%. However, only 944 were used in each of the analyses in this article, because of missing data in the remaining 87.

Several questions were asked of the farmers as to their preferences for autonomy. The first was "How important is it to you to have complete control over all production, marketing, and management decisions in your hog operation?" Potential answers were "not important at all," "not very important," "somewhat important," and "very important." Thus, this question examined the importance the farmer places on having control over the operation. The second question was "Approximately what percentage of the production, marketing and management decisions do you make in your operation?" Potential answers were "I make none of these decisions," "I make few of these decisions," "I share these decisions equally with another party," "I make most of these decisions," and "I make all of these decisions." Thus, this question dealt not solely with a farmer's preference for autonomy but also with the portion of decisions that are actually made on the farm. The reader is cautioned against categorizing answers to this question purely as revealed preferences for autonomy, because factors other than autonomy have likely also entered into the farmer's preference in the business arrangement selection decision. A follow-up question asked "Approximately what portion of the everyday production, marketing and management decisions would you prefer to make?" Potential answers were "I prefer to make none of these decisions," "I prefer to make few of these decisions," "I prefer to share these decisions equally with another party," "I prefer to make most of these decisions," and "I prefer to make all of these decisions." Thus, this question measured the portion of decisions the producer would prefer to make if he or she could hold all other factors constant in the business arrangement selection decision.

Follow-up questions dealt with preferences regarding responsibility for specific management tasks. The preferences of farmers over each of these specific management tasks represent subattributes of autonomy. Each of these questions was answered simply as "yes" or "no" and included "Would/Do you prefer determining the type of feed used in the production process over allowing a contractor or integrator to determine the type of feed," "Would/Do you prefer determining the market in which to sell finished hogs over allowing a contractor or integrator to make this decision," "Would/Do you prefer having full control over herd size and the number of hogs to be marketed each period over allowing a contractor or integrator to make this decision," "Would/Do you prefer determining the type of equipment and facilities used in your production process over allowing a contractor or integrator to make this decision," and "Would/Do you prefer to determine when to place and remove your hogs, rather than having a contractor or integrator to make this decision?"

To determine the type of farmer who is likely to prefer a higher level of autonomy, limited dependent-variable models were used

with the measure of autonomy as the dependent variable and farmer and farm attributes as the independent variables. Given the ordinal nature of the dependent variables, "How important is it to you to have complete control over all production, marketing, and management decisions in your hog operation?" (with four potential ordered answers) and "Approximately what percentage of the production, marketing and management decisions do you make?" and "Approximately what percentage of the production, marketing and management decisions would you prefer to make in your operation?" (both with five potential ordered answers), ordered probit analyses are appropriate for determining the effect of independent variables on autonomy preference. Suppose that $y^* = \beta' x + \varepsilon$. Suppose that y^* is unobserved but that the following is observed:

$$\begin{aligned} y &= 0 \quad \text{if } y^* \leq 0, \\ y &= 1 \quad \text{if } 0 < y^* \leq \mu_1 \\ y &= 2 \quad \text{if } \mu_1 < y^* \leq \mu_2 \\ &\vdots \\ y &= J \quad \text{if } \mu_{J-1} \leq y^*. \end{aligned}$$

In this case, the μs are unknown parameters to be estimated with β. Under the assumption of a normalized mean and variance for ε of 0 and 1, respectively, the following probabilities are estimated with the ordered probit model (Greene):

$$\begin{aligned} (1) \quad & \Pr(y = 0) = \Phi(-\beta' x), \\ & \Pr(y = 1) = \Phi(\mu_1 - \beta' x) - \Phi(-\beta' x), \\ & \Pr(y = 2) = \Phi(\mu_2 - \beta' x) - \Phi(\mu_1 - \beta' x), \\ & \qquad \vdots \\ & \Pr(y = J) = 1 - \Phi(\mu_{J-1} - \beta' x). \end{aligned}$$

Φ is a notation for the standard normal cumulative distribution function. For positive probabilities, $0 < \mu_1 < \mu_2 < \cdots < \mu_{J-1}$ must hold. Because a stratified sample was used, data in the regression were weighted according to size stratification, with the base population being the total list of producer subscribers to *National Hog Farmer* magazine.

We are aware of only one other analysis that has examined the effect of exogenous variables on autonomy. Gillespie examined only the effect of age on autonomy preference. That study was conducted with a smaller number of observations (20). Thus, little previous research exists from which to predict the signs of independent variables. The independent variables included in this analysis are the following.

Size was measured as the number of hogs sold in 1999 in the operation. There are five dummy variables for this measure, where 200–999 hogs sold is the base: 1,000–1,999 hogs (*Size 2*), 2,000–2,999 hogs (*Size 3*), 3,000–4,999 hogs (*Size 4*), 5,000–9,999 hogs (*Size 5*), and 10,000 or more hogs (*Size 6*). There is little basis to predict a sign. On the one hand, larger farmers may prefer to make more of the decisions because the downside risk of a poor management decision is potentially greater. On the other hand, the farmer's span of control is greater with a larger number of hogs; thus, management specialization among multiple managers may be advantageous.

Dummy variables representing two segments of the hog production sector are included: *Farrower* and *Finisher*. These variables indicate that the farmer operates a farrowing and/or a finishing unit, respectively. It is expected that farrowing unit operators place greater value on autonomy than do nonfarrowers because of the greater management required of a farrowing operation. Farrowers must make a number of crucial management decisions that heavily affect net returns, including, but not limited to, how and when to breed and culling decisions. Substantial labor is required for this phase; this is likely to result in more nonfamily wage employees. In the case where the operator does not have control over the management of the operation, there is the risk of other managers making decisions that are in conflict with those that would otherwise be made by the farmer. On the other hand, finishing hogs to about 250 pounds arguably requires less-intensive management, because the major task at hand is feeding. It is hypothesized that farmers in this phase will

accept a lower level of autonomy because the associated tasks do not require the extent of management of other phases.

Diversification is a summation of the number of enterprises other than hog production on the farm. It is expected that more diversified operators would be less favorable toward complete autonomy with respect to the hog operation. One's ability to effectively manage multiple enterprises is limited; thus, the farmer is likely to be willing to reduce autonomy in one enterprise so that management decisions can be shared with another party.[1]

Off-Farm Income is the percentage of the farmer's household income derived from off-farm sources. The hypothesized sign of this variable is indeterminate *a priori.* Using the same argument as the *Diversification* variable, the farmer's limited span of control over multiple activities may cause him or her to welcome the shared management opportunities offered by a business arrangement other than independent production. Alternatively, he or she may value the autonomy associated with independent farm production if his or her level of autonomy is low in the off-farm job.

The variable *Southeastern U.S.* indicates that the farmer was located in one of the following states: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, South Carolina, Tennessee, Texas, or Virginia. *North Carolina* indicates the farmer was located in North Carolina. Contract hog farming has been located to a great degree in the southeastern U.S., most notably in North Carolina, and to a lesser degree in some other southeastern states. The inclusion of this variable allows for testing whether southeastern producers actually have a lesser preference for autonomy or whether other factors (such as a lack of alternative markets for hogs and/or the acceptance of contracting as a "fact of life," as a result of the similar previous reorganization of the broiler industry) have influenced their greater selection of contracting. Separating North Carolina from the others allows for the determination of whether North Carolina producers specifically have a lesser preference for autonomy than do other producers, given the very rapid expansion of contracting in the state.

Farmer attributes include *Age, Age Squared,* and *College.* Each of these variables has been included and found to be significant in studies that dealt with job satisfaction (e.g., Vandenheuvel and Wooden). It is expected that younger farmers place a lower value on autonomy than do older farmers. Younger farmers are more likely to benefit from shared management because, early in their careers, they have limited experience. Gillespie found that age was positively associated with autonomy preference. It is, however, also expected that farmers nearing retirement value autonomy less than those in the middle of their careers. These farmers are expected to be interested in shifting management responsibilities to the next generation and/or sharing management with another party (not necessarily a contractor) as they are phased out of the business. As was discussed by Boehlje, the major goal in this phase of the life cycle is to increase and/or retain assets for financial stability during retirement. Thus, *Age Squared* allows for the curvilinear relationship of age and autonomy. It is expected that educated farmers value autonomy more because of their greater management expertise. Thus, *College* is expected to be positively related with a greater preference for autonomy.

Relationships with Neighboring Farmers is a variable that measures the relationship of social capital with the preference for autonomy. Robison and Hanson included the influence of relationships in a neoclassical economic model, emphasizing their importance in economic decision making. In the present study, farmers were asked "With respect to your social relationships and farm operation, how important (is your) relationship with neighboring farmers?" Potential answers were "not important

[1] It is, however, recognized that some types of more diverse operations may be less able to adopt contracts or less able to benefit from economies of scope, due to contract terms. An example of a constraint on economies of scope would be the corn farmer who is prohibited from feeding farm-raised corn to hogs due to contract terms. This, however, would affect the level of autonomy allowed under the contract, rather than the level of autonomy preferred.

at all," "not very important," "somewhat important," and "very important." This variable is included for exploratory purposes. On the one hand, it might be expected that those who value relationships with neighboring farmers higher will value autonomy more. Better relationships with other farmers allows for sharing of information, which can improve production efficiency. Such relationships can serve as a substitute information source for the information gained through shared management, thus allowing an independent farmer to increase efficiency. On the other hand, those who place greater value on relationships with other farmers may be more open to shared management arrangements with them via strategic alliances, cooperative membership, or contracts.

Three independent variables in the regressions dealing with autonomy preference were considered to be endogenous variables. These were *Sole Proprietor,* which indicated the firm was a sole proprietorship, *Contract,* which indicated the farmer was under a production contract, and *Cooperative,* which indicated that the farmer was a member of a hog production cooperative. Thus, instrumental variables were estimated for each, with predicted values, in turn, used in the autonomy regressions. Because, for each of these variables, the farmer answered either "yes" or "no" with regard to whether the term described his or her farm, binomial probit analyses are suitable. The probit model follows (Greene):

$$(2) \qquad \Pr(Y = 1) = \int_{-\infty}^{\beta' x} \phi(t)\, dt = \Phi(\beta' x).$$

Probit models to estimate the instrumental variables included the following explanatory variables: *Farrower, Finisher, Diversification, Off-Farm Income, Age, Age-Squared, College, Debt/Asset Ratio, Farmer is Risk Averse* (measured by asking the producer to rate himself as more or less risk averse than other farmers in financial investment decisions), *Corn Produced* (indicating that the farmer also raises corn), *Value of Farm Assets,* and the five size-category dummy variables estimated in the autonomy equations. Given the rapid expansion of contracting in the Southeastern United States, especially North Carolina, *Southeastern U.S.* and *North Carolina* were included in the *Contract* equation.

It is expected that sole proprietors value autonomy more than do farmers under any of the other business structures because they have elected to be the sole owner and, likely, the sole manager and operator. *Contract* and *Cooperative Member* are included, to explore whether farmers under alternative business arrangements have different preferences for autonomy when they are included in a multivariate analysis that includes farm size, farm structure, and socioeconomic variables. A *Contract* as defined in the survey provides farmers with inputs such as feeder pigs, feed, veterinary services, and medication, whereas the farmer supplies the labor, utilities, buildings, and fuel. The contract provides the farmer with a payment that is rewarded on the basis of productivity. Contractors are not included in this category because farmers were to indicate whether they produced hogs under a contract. *Cooperative Member,* as defined in the survey, refers to the farmer being involved in a jointly owned farm enterprise consisting of the farmer and one or more other farmers who combine resources and/or expertise to finance, produce, and/or sell hogs. In most cases, farmers under each of these alternative business arrangements have given up some autonomy in choosing a business arrangement other than independent production. The inclusion of these variables allows for investigation as to whether the farmers actually value autonomy less than independent farmers. Of the data from 944 producers used in the analysis, 486 were sole proprietors, 199 were contract producers, and 68 were cooperative producers.

Results

Table 1 reports the percentages of farmers answering each of the three autonomy questions, by size category. For the question "How important is it for you to have complete control over all production, marketing, and management decisions in your hog operation," farmers in each size category were more likely to

Table 1. Percentages of Producers Answering Each of the Questions Dealing with Autonomy, n = 944

	Size Category, Number of Hogs					
Question	200–999	1,000–1,999	2,000–2,999	3,000–4,999	5,000–9,999	>10,000
How important is it for you to have complete control over all production, marketing, and management decisions in your hog operation?						
Not important at all	3.4[a]	6.4[bc]	4.8[ab]	5.9[cd]	9.5[d]	10.7[d]
Not very important	2.0	7.0	2.7	7.1	7.4	8.9
Somewhat important	27.2	22.9	24.4	32.0	36.3	36.6
Very important	67.3	63.7	68.0	55.0	46.8	43.8
Approximately what portion of the everyday production, marketing, and management decisions do you make on your operation?						
I make none of these decisions	2.0[a]	3.8[a]	5.3[ab]	4.1[bc]	5.8[c]	1.8[c]
I make few of these decisions	4.7	6.3	4.7	9.9	10.5	14.9
I share these decisions equally with another party	20.1	17.0	23.3	27.5	28.3	32.5
I make most of these decisions	19.5	21.4	25.3	26.9	28.8	25.4
I make all of these decisions	53.7	51.6	41.3	31.6	26.7	25.4
Approximately what percentage of the production, marketing, and management decisions would you prefer to make?						
I prefer to make none of these decisions	2.0[a]	6.3[a]	5.4[b]	4.1[c]	6.9[c]	4.4[c]
I prefer to make few of these decisions	5.4	5.0	3.4	10.0	10.1	14.2
I prefer to share these decisions equally with another party	16.8	18.9	30.2	30.0	28.6	33.6
I prefer to make most of these decisions	30.2	27.7	26.8	30.0	34.9	24.8
I prefer to make all of these decisions	45.6	42.1	34.2	25.9	19.6	23.0

Notes: Lower case letters by distributions indicate differences in proportions using a χ^2 test at the 0.05 probability level. Different (the same) letters within questions indicate that the distributions were (not) found to be significantly different.

answer "very important" than any of the other options. Percentages answering "very important" ranged from 43.8% in the largest size category to 68.0% in the 2,000–2,999 hog size category. For the question "Approximately what portion of the everyday production, marketing and management decisions do you make on your operation," most farmers made either most of the decisions or all of the decisions. Fewer than 6% of the farmers in all size categories made none of the decisions. For the question "Approximately what portion of the everyday production, marketing and management decisions would you prefer to make," again, most of the farmers preferred to make either all or most of the decisions.

A main-effects model was used to analyze the relationship between the category chosen and the size group. Marginal probabilities were estimated in a linear model using the CATMOD procedure in SAS (SAS Institute). Results using a χ^2 test at the 0.05 probability level showed that, for all three questions, the larger operations had different distributions than did the smaller ones, with larger producers generally placing less emphasis on autonomy. Similar tests were run to examine whether there were differences in response between the second two questions dealing with the portion of decisions actually made and the portion that the producer preferred to make. There were no significant differences for any size category, providing no evidence that proportions of actual decisions made versus preferred proportions of decisions made differed.

Results of the binomial probit analyses to estimate the instrumental variables, *Sole Proprietor, Contract,* and *Cooperative* are included in Table 2. Producers who farrowed sows, were more diversified, held a college degree, or whose operations were larger were less likely to be sole proprietors, whereas producers whose farm assets were valued higher were more likely to be sole proprietors. Thus, as expected, the larger, less diversified, more educated farmers with operations that required greater management expertise were more likely to choose a business structure other than sole proprietorship, such as a partnership or corporate structure. One notices that the percentage correctly predicted is lower for the sole proprietor equation than either the contract or cooperative equations. Such results are often found when the independent variable is more evenly distributed between the two values—nearly equal numbers of producers were sole proprietor versus other business structures.

Farmers who farrowed sows, were nearing retirement, held a college degree, or had a higher debt-asset ratio were less likely to be contract producers, whereas producers in North Carolina, whose assets were valued higher, or whose operations were larger were more likely to be contract producers. Older producers were less likely to be members of a cooperative, whereas those who held college degrees or whose operations were very large ($\geq$10,000 animals) were more likely to be members of a cooperative. The results of the instrumental variable models are not the focus of this article and thus are not discussed in detail. However, economic theory, as well as the authors' experience with the industry, led to the conclusion that the results are as expected.

Results of the ordered probit analyses of the effect of size, business structure, farm type, and farmer characteristics on attitudes toward autonomy are presented in Table 3. For the question "How important is it for you to have complete control over all production, marketing and management decisions in your hog operation," as expected, farmers who farrowed sows were more likely to place greater importance on having complete control. Farmers who produced in North Carolina or were relatively large ($\geq$5,000 hogs) placed less importance on having complete control over the hog operation.

For the question "Approximately what portion of the everyday production, marketing and management decisions do you make on your operation," sole proprietors, farmers who farrowed sows, farmers were members of a cooperative, and older farmers were more likely to make a higher portion of these decisions. Alternatively, farmers who received a greater percentage of their income from off-farm sources, who were located in North Carolina,

Table 2. Estimation of Instrument Variables via Binomial Probit Models (n = 944)

	Sole Proprietor		Contract Producer		Cooperative	
Variable	Coefficient	SE	Coefficient	SE	Coefficient	SE
Constant	0.95438***	0.23403	−0.17514	0.33047	−1.64068***	0.38587
Farrower	−0.23138***	0.08628	−1.46304***	0.12598	0.17790	0.14341
Finisher	−0.16667	0.12895	−0.12423	0.15475	−0.27878	0.18733
Diversification	−0.07356**	0.02865	−0.02247	0.03925	−0.04972	0.04569
Off-farm income	−0.00010	0.00058	−0.00012	0.00076	0.00161	0.00147
Age	0.00032	0.00049	0.00059	0.00070	−0.00097*	0.00053
Age squared	−0.00000	0.00004	−0.00016***	0.00006	−0.00009	0.00007
College	−0.16442*	0.09754	−0.24879*	0.13579	0.27711*	0.14612
Southeastern U.S.	n/a	n/a	0.33309	0.29432	n/a	n/a
North Carolina	n/a	n/a	1.97118***	0.45223	n/a	n/a
Debt/asset ratio	0.00002	0.00017	−0.00094***	0.00021	0.00029	0.00031
Farmer is risk averse	0.00033	0.00034	0.00064	0.00054	−0.00001	0.00048
Corn produced	0.18087	0.13137	−0.24407	0.17132	0.05113	0.04630
Value of farm assets	0.00030*	0.00015	0.00047***	0.00021	−0.00009	0.00028
Size						
1,000–1,999	−0.06849	0.16360	0.49144*	0.26659	−0.52094	0.34834
2,000–2,999	−0.38558**	0.18009	0.32003	0.29291	0.24559	0.32238
3,000–4,999	−0.70895***	0.18787	0.56158*	0.29195	0.42378	0.32106
5,000–9,999	−0.80651***	0.18969	0.94436***	0.28282	0.50236	0.32061
≥10,000	−0.91399***	0.18151	1.18787***	0.27718	0.71486**	0.30758
McFadden R^2	0.0664		0.2912		0.0789	
% correctly predicted	65.042		82.309		92.797	

Note: *, **, and *** indicate that the variable is significant at the 0.10, 0.05, and 0.01 probability levels, respectively.

Table 3. Ordered Probit Results for Autonomy Questions, n = 944

	Importance of Decision Control		Portion of Decision Made		Portion of Decisions Preferred	
Variable	Coefficient	SE	Coefficient	SE	Coefficient	SE
Constant	1.54077***	0.25242	2.27940***	0.25263	2.40705***	0.24962
Sole proprietor	0.07236	0.11387	0.24615**	0.10561	0.10253	0.10484
Farrower	0.57963***	0.08811	0.43390***	0.08068	0.28987***	0.07917
Finisher	−0.08366	0.11759	−0.15869	0.10984	−0.23835**	0.10953
Diversification	−0.00122	0.00313	−0.02873	0.02225	−0.03106	0.02209
Off-farm income	−0.00208	0.00133	−0.00344***	0.00123	−0.00276**	0.00122
Contract	0.07593	0.14456	0.13191	0.13666	0.04520	0.13685
Cooperative	3.58242	2.76864	5.97350**	2.58748	4.60207*	2.57096
Age	0.00057	0.00047	0.00087**	0.00040	0.00080**	0.40712
Age squared	0.00001	0.00004	−0.00010***	0.00003	−0.10827***	0.00003
College	−0.11059	0.09191	−0.01424	0.08474	0.02326	0.08336
Southeastern U.S.	0.07201	0.23092	−0.12465	0.19441	0.04156	0.19442
North Carolina	−0.54464**	0.25630	−0.61065**	0.24602	−0.48617**	0.24619
Farmer relationship	−0.00019	0.00034	−0.00040	0.00030	−0.00067**	0.00032
Size						
1,000–1,999	−0.14123	0.15663	−0.05083	0.14277	−0.15088	0.13888
2,000–2,999	−0.01170	0.17738	−0.28975*	0.15885	−0.34704**	0.15566
3,000–4,999	−0.26458	0.19043	−0.38819**	0.17552	−0.48363***	0.17271
5,000–9,000	−0.43101**	0.19785	−0.46592**	0.18515	−0.58834***	0.18262
≥10,000	−0.56628***	0.19378	−0.52227***	0.18324	−0.64565***	0.18077
μ_1	0.38915***	0.03943	0.64761***	0.04820	0.51195***	0.04356
μ_2	1.36511***	0.05471	1.51225***	0.04211	1.40012***	0.04112
μ_3	—	—	2.17434***	0.04680	2.17348***	0.04701
McFadden R^2	0.0507		0.0422		0.0330	

Note: *, **, and *** indicate that the variable is significant at the 0.10, 0.05, and 0.01 probability levels, respectively.

or whose operations were larger (≥2,000 hogs) were more likely to make a smaller portion of these decisions. The age-squared variable was negative, indicating a quadratic relationship between age and the portion of decisions made by the respondent.

For the question, "Approximately what portion of the everyday production, marketing and management decisions would you prefer to make," farmers who farrowed sows, were members of a cooperative, and were older were likely to prefer to make a higher portion of these decisions. Farmers who had more hogs, were finishers, received a higher percentage of income from off-farm sources, were located in North Carolina, or valued relationships with other farmers higher were more likely to prefer to make a smaller portion of these decisions relative to other farmers. As with the previous question, the significance and negative sign of the age-squared variable indicates a curvilinear relationship between age and the portion of decisions preferred to be made by the respondent.

One variable that was not significant in any of the three runs was *Contract*. This suggests that, accounting for the error associated with these variables through an instrumental variable, whether the individual was under contract did not influence autonomy preference. This should not be interpreted, however, to suggest that autonomy preference did not initially influence the decision as to whether to accept a contract or to become a member of a cooperative.

Table 4 shows the percentages of farmers answering "yes" to questions regarding whether the farmer would prefer to manage specific tasks in the operation, relative to having a contractor or integrator make this decision. The difference in proportions test (Zar, pp. 395–397) was used to compare the difference in proportions answering "yes" to questions dealing with these tasks. The equation used to calculate test statistic Z is

$$(3) \quad Z = \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{\frac{\bar{p}\bar{q}}{n_1} - \frac{\bar{p}\bar{q}}{n_2}}},$$

where $\hat{p}_i$ represents the proportion of respondents answering "yes" in group i, $\bar{p}$ and $\bar{q}$ represent the proportion of all respondents in both groups answering "yes" and "no," respectively, and n_i represents the total number of respondents in group i. The critical $t_{0.05(2),\infty}$ was used.

Results indicate that smaller farmers were more likely to prefer determining the type of feed to be used in the operation, the market in which to sell finished hogs, the herd size and number of hogs to be marketed each period, and when to place and remove hogs. The biggest differences generally occurred between the size categories with 5,000 or more hogs versus the categories with fewer than 5,000 hogs. Significant differences were not found across size categories for the question regarding whether the farmer preferred to determine the type of equipment and facilities to use in the operation.

Generally, farmers were less concerned about allowing a contractor or integrator to determine the type of feed to be used and the market in which to sell finished hogs, relative to the other three decisions. Having control over herd size, determining equipment and facility types, and determining the placement and removal of hogs were of relatively greater importance to farmers in most size categories.

Summary, Conclusions, and Implications

The results of this study offer insights into farmers' preferences for autonomy. Generally, older farmers preferred higher levels of autonomy than other farmers, a result that was not surprising. Established farmers have likely, through experience, developed management strategies that have proved effective, and the prospect of sharing these responsibilities with another party who may not be perceived to have as much experience is unlikely to be favored. It is of interest, however, that the age-squared variable had a negative sign and was significant in two of the runs. This is consistent with the general life cycle of farmers—the transfer of ownership and management responsibilities to another party, perhaps the next generation, as a farmer nears retirement

Table 4. Answers to Questions Regarding the management of Specific Tasks Conducted in the Hog Operation, n = 944

	Size Category, Number of Hogs					
Question	200–999	1,000–1,999	2,000–2,999	3,000–4,999	5,000–9,999	>10,000
Would/Do you prefer determining the type of feed used in the production process over allowing a contractor or integrator to determine the type of feed?	79.2[a,a]	78.0[ab,a]	73.7[ab,a]	77.6[ab,a]	67.5[b,abc]	67.3[ab,ad]
Would/Do you prefer determining the market in which to sell finished hogs over allowing a contractor or integrator to make this decision?	84.9[a,ab]	78.5[a,a]	77.2[a,ab]	80.0[a,ab]	64.2[b,a]	60.0[b,a]
Would/Do you prefer having full control over herd size and the number of hogs to be marketed each period over allowing a contractor or integrator to make this decision?	90.6[a,b]	88.7[a,b]	86.6[a,bc]	83.5[ab,abc]	74.3[bc,bd]	71.1[c,ac]
Would/Do you prefer determining the type of equipment and facilities used in your production process over allowing a contractor or integrator to make this decision?	93.3[a,b]	91.2[a,b]	91.3[a,c]	92.4[a,bc]	88.9[a,c]	83.9[a,b]
Would/Do you prefer to determine when to place and remove your hogs, rather than having a contractor or integrator make this decision?	90.6[a,b]	91.2[a,b]	89.3[a,c]	88.9[a,bc]	77.5[b,de]	75.0[b,bcd]

Notes: Superscripts denote differences in percentages of respondents answering "yes" across size categories for a particular question (before the comma) and across questions for a particular size category (after the comma) at the 5% level. The same letter in a superscript indicates there was no significant difference among size categories (before the comma) or among questions (after the comma).

is likely to be associated with a decreased preference for autonomy. The overall results are consistent with findings by Davis that independent farmers are older, on average, than contract and cooperative farmers.

Contract farmers have less control over a number of aspects of their operations than independent farmers. The instrumental variable run showed that producers in North Carolina, who had lower debt/asset ratios, whose operations were larger, and who tended not to hold college degrees were more likely to be contract producers. Results of the autonomy runs did not, however, provide evidence to support the hypothesis that contract producers are likely to value autonomy less than independent producers. Once the error associated with being a larger, southeastern, nonfarrowing producer was considered, contracting did not have a significant influence on autonomy preferences. This should not be interpreted to suggest, however, a lack of influence of autonomy preference on business arrangement selection.

We note that larger farmers tended to value autonomy less, according to both the tests of proportions and the multivariate analyses. The realization that, as an operation grows in size, the farmer's span of control is constrained, likely influences the farmer's preference for autonomy. This result was consistent in all of the runs, as well as with the analysis of the subattributes of autonomy. We also note, however, that the results of the study may not hold for the very small farmers, those with fewer than 200 hogs.

The segment of the industry in which the farmer was involved was significant in several of the runs. Those who farrowed pigs placed greater importance on autonomy than did other farmers. We hypothesized that farrowers would prefer greater autonomy because of the greater impact of management decisions on net returns in that segment. Effective farrowing requires a farmer to monitor heat, breed sows at the correct time, conduct tasks associated with farrowing, and properly manage pigs after birth. A sufficiently high level of trust must develop between a farmer and another party in order for the farmer to be willing to relinquish control over key management decisions to the other party. These results suggest that the more task-specific an operation, the less likely that the farmer will be willing to share management responsibilities. This suggestion would need further testing to become well established. On the other hand, finishers were less concerned with making all of the decisions associated with the operation. The generally lower level of management required for finishing likely explains the greater willingness of finishers to relinquish these responsibilities to another party. Related to this are the decisions that farmers are more likely to be willing to share with another party. There tended to be less willingness to relinquish control over longer-run decisions such as herd size, equipment type, and the timing of hog placement and removal than feed type or marketing decisions.

Greater diversification appears to be associated with more willingness to share management responsibilities with another party. This is likely because of the greater span of control required of more diversified operators and the associated greater need for management assistance. The individual who specializes develops a greater depth of expertise in the area and is, thus, less willing to share responsibilities with another party.

Results of the social capital variable assessing the importance of the farmer's relationships with other farmers suggest that those who rate social relationships with other farmers as more important were less likely to prefer to make all decisions in their operations. This is consistent with the argument that greater value placed on these relationships may lead farmers to form strategic alliances with other farmers, thus likely reducing autonomy. Davis found that contract and cooperative farmers rated relationships with farmers as more important than did independent farmers. Contracting among farmers and cooperative membership require the development of trusting relationships among parties.

Of interest was that southeastern farmers other than those in North Carolina did not indicate a lower level of preference for autonomy than did other farmers. Given that North Carolina farmers indicated less of a desire to

make their own decisions, it is possible that widespread contracting in the state has caused these farmers to have greater acceptance of contracting or to see the benefits associated with shared management. This is an area that needs more thorough investigation.

Although these results are likely to hold for hog farmers and have implications for all farmers, differences are expected among farmers depending on the enterprises in which they are involved. Broiler production has been quasi vertically integrated for the past half-century. Midwestern grain farmers have generally cooperated more with other farmers in the marketing of their products than have cattle farmers; it is uncertain whether autonomy preferences would differ among these farmers. What is known is that goal structures differ among farmers of different commodities. For instance, Basarir found that Louisiana beef-cattle farmers weighted conservation and land maintenance goals higher than financial goals, whereas Louisiana dairy farmers placed heavier weights on financial goals. It would be of interest to examine differences in attitudes toward autonomy over farmers of different enterprises.

The results of this study indicate a relatively strong preference for autonomy among U.S. hog producers. Although there are benefits to contracting (price risk reduction and capital acquisition, to name two), farmers stand to lose a valued attribute associated with traditional farming as contracting continues to expand. This sentiment was reflected in the relatively large number of negative comments toward contracting that were hand-written on many of the returned surveys. Nonetheless, the results do show some differences in farmer type and autonomy preference. Results lead one to question whether the preference for autonomy will be as great in the future as farms expand in size and today's older farmers retire. However, even these results do not indicate that the preference for autonomy will cease to be important—a solid majority of farmers in the largest size categories preferred to make most or all of the decisions in their operations. The concern over loss of autonomy appears to continue in the broiler industry, in which larger producers capturing significant economies of size are almost 100% contracted. Complaints of the control of broiler contractors over grower operations have prompted the formation of broiler grower organizations. The current trend leading to a lessened span of control over business decisions, along with the preference for autonomy, helps to explain the substantial efforts placed with respect to anti–corporate farming legislation in some states.

[Received June 2003; Accepted January 2004.]

References

Basarir, A. "Multidimensional Goals of Farmers in the Beef Cattle and Dairy Industries." Ph.D. dissertation, Louisiana State University, June 2002.

Boehlje, M. "Alternative Models of Structural Change in Agriculture and Related Industries." *Agribusiness* 8(1992):219–31.

Davis, C.G. "Factors Affecting the Selection of Business Arrangements by Hog Farmers in the United States." Ph.D. dissertation, Louisiana State University, July 2002.

Dillman, D.A. "The Design and Administration of Mail Surveys." *Annual Review of Sociology* 17(1991):225–49.

Eden, D. "Self-Employed Workers: A Comparison Group for Organizational Psychology." *Organizational Behavior and Human Performance* 9(1973):186–215.

Fulton, J., and J. Gillespie. "Emerging Business Organizations in a Rapidly Changing Pork Industry." *American Journal of Agricultural Economics* 77(December 1995):1219–24.

Gillespie, J.M. "The Effect of Risk and Autonomy on Hog Producers' Contracting Decisions." Ph.D. dissertation, University of Minnesota, October 1993.

Gillespie, J.M., and V.R. Eidman. "The Effect of Risk and Autonomy on Independent Hog Producers' Contracting Decisions." *Journal of Agricultural and Applied Economics* 30(July 1998):175–88.

Greene, W.H. *Econometric Analysis,* 4th ed. Upper Saddle River, NJ: Prentice Hall, 2000.

Grey, M.A. " 'Those Bastards Can Go to Hell!': Small-Farmer Resistance to Vertical Integration and Concentration in the Pork Industry." *Human Organization* 59(Summer 2000):169–76.

Hundley, G. "Why and When Are the Self-Em-

ployed More Satisfied with Their Work?" *Industrial Relations* 40(2001):293–316.

Johnson, C.S., and K.A. Foster. "Risk Preferences and Contracting in the U.S. Hog Industry." *Journal of Agricultural and Applied Economics* 26(1994):393–405.

Katz, J.A. "How Satisfied Are the Self-Employed: A Secondary Analysis Approach." *Entrepreneurship Theory and Practice* 17(1993):35–51.

Kaufmann, P.J. "Franchising and the Choice of Self-Employment." *Journal of Business Venturing* 14(1999):345–62.

Keeney, R.L., and H. Raiffa. *Decisions with Multiple Objectives: Preferences and Value Tradeoffs.* Cambridge: Cambridge University Press, 1993.

Kliebenstein, J.B., D.A. Barrett, W.D. Hefferman, and C.L. Kirtley. "An Analysis of Farmers' Perceptions of Benefits Received from Farming." *North Central Journal of Agricultural Economics* 2(1980):131–36.

Lawrence, J.D., G. Grimes, and M. Hayenga. "Production and Marketing Characteristics of U.S. Pork Producers, 1997–1998." Staff Paper No. 311, Dept. of Econ., Iowa State University, 1998.

Paarlberg, D. *American Farm Policy.* New York: John Wiley and Sons, 1964.

Robison, L.J., and S.D. Hanson. "Social Capital and Economic Cooperation." *Journal of Agricultural and Applied Economics* 27(July 1995): 43–58.

Vandenheuvel, A., and M. Wooden. "Self-Employed Contractors and Job Satisfaction." *Journal of Small Business Management* 35(1997): 11–20.

Weaver, C.N., and R.S. Franz. "Work-Related Attitudes of Entrepreneurs, Public and Private Employees." *Psychological Reports* 70(1992):387–90.

Zar, J.H. *Biostatistical Analysis,* 2nd ed. Englewood Cliffs, NJ: Prentice-Hall, 1994.