# Purchasing Patterns of Hog Producers: Implications for Rural Agribusinesses

## John D. Lawrence, Daniel Otto and Seth Meyer

*Abstract: The consolidation of pork production into fewer and larger operations has implications for rural agribusinesses that have traditionally serviced producers. This study examines purchasing patterns of existing pork producers for production inputs by size of operation. Distance traveled to purchase inputs and reasons for bypassing the nearest supplier are evaluated as are the characteristics of producers that are most likely to bypass a supplier. In general, producers with characteristics to be competitive in the pork industry are those most likely to bypass the local supplier.*

*Key Words and Phrases: Rural businesses, Pork production, Purchasing decisions.*

The dramatic changes in the structure of the U.S. pork industry raise serious concerns for existing producers as well as rural-based agribusinesses that have traditionally serviced agriculture. The structural change in the hog industry is manifested by the dramatic decline in the number of producers and the growth in average herd size of remaining producers. Since 1970, the number of U.S. farms raising hogs has declined from 900,000 to less than 250,000 in 1992, according to the Census of Agriculture (U.S. Census Bureau). The average inventory has risen from 85 to 286 hogs per farm during this same time period. Nationally, at the end of 1995, 60 percent of the hogs were on approximately 12,400 farms with an inventory of at least 1,000 head (U.S. Census Bureau). This percentage increased from 44 percent in December, 1991. Even more dramatic change is apparent in the North Carolina hog industry, which moved from the eighth largest hog producing state in 1986 to second largest in 1994, primarily by developing large-scale confinement facilities. In addition to having possibly several thousand hogs on a given farm, one decision maker may make management and purchasing decisions on multiple farms. This pattern of expansion in the hog industry is also beginning to occur in the major corn and hog producing states of the Midwest.

Rural areas are concerned with the changing structure of the hog industry for several reasons. Environmental issues, including water quality and odor problems from large hog facilities, are dominant concerns in many areas. Economic impacts on agribusinesses in regions being affected by the structural changes in the hog industry are another major concern. The loss of producers in a region are a concern to

Figure 1.
*Percent of Hog Inventory by Size of Operation, U.S. and Iowa, 1995*
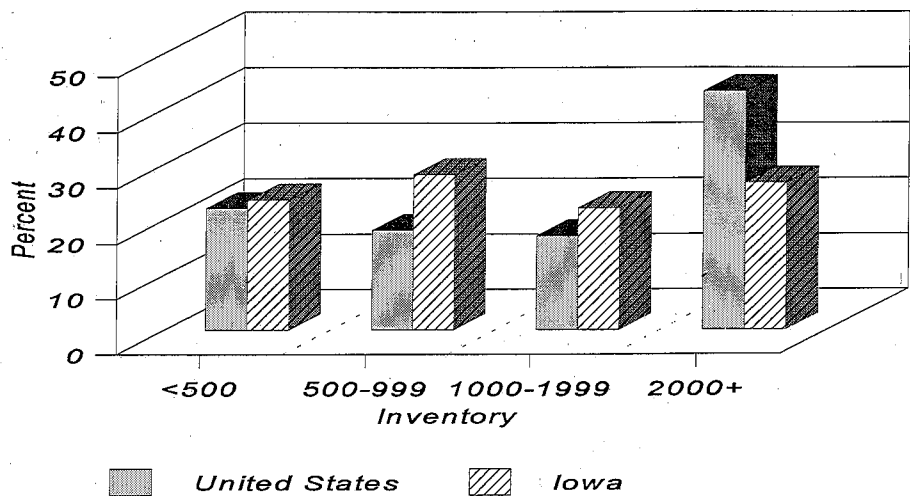


mainstreet businesses that rely on customer volume for sales. However, the growth of large-scale hog facilities could actually increase overall hog production and the volume of agribusiness-related activities in an area. The shift toward hog facilities of this size is likely to create different patterns of input uses and purchases compared to a situation of many small-scale hog producers. Some of the largest operations are directly linked to specific input suppliers and/or buy inputs for a number of growers representing millions of hogs. Because of their larger scale of operation, larger producers are more likely to bypass local suppliers by buying direct from manufacturers in large quantities, often at a price discount. The independent producers that remain in this increasingly competitive industry will likely alter their input purchasing patterns compared to previous years. Agribusinesses are caught between supporting, or possibly facilitating, larger units, and struggling with the decline of traditionally smaller and often more loyal customers (Hogeland).

Most previous investigations of hog industry impacts have focused on the economy-wide impacts of the sector or industry growth scenarios (DiPietre and Watson; Otto and Lawrence). Other studies have been concerned with a component of the industry, such as gains or losses of meat packing firms (St. Clair et al.). This paper examines implications of changes in the structure of the hog industry for agribusinesses in rural communities. A survey of Iowa hog producers' input purchasing patterns is used in the analysis. Sources of various purchased inputs, the

Figure 2.

*Percent of Hog Inventory on Farms with 1,000 Head or Larger Inventory*
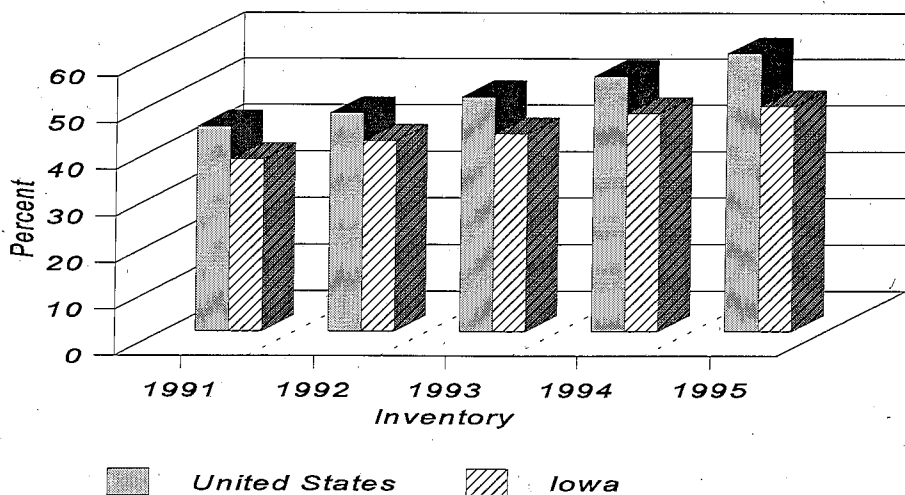


distance producers are willing to travel to buy these inputs, and their reasons for bypassing the nearest supply source were examined in this survey. Because of movement toward larger-scale hog operations, our major interest lies in how these patterns vary in relation to size of operation and other key producer characteristics. Iowa is an appropriate state for studying this issue because of its prominence in the hog industry. Twenty-seven percent of total 1993 U.S. hog production was based in Iowa. The structural changes occurring within the Iowa pork industry mirror the changes in the United States as a whole. While the mean hog farm size in Iowa is larger than the U.S. average, Iowa's production has come primarily from small to medium-size farms (Figure 1). Likewise, the trend to farms with 1,000 head or more inventory is comparable between Iowa and the United States (Figure 2). The Iowa hog industry, which has had a traditionally diffuse structure, has recently seen the development of large firms in the state. Given the declining production from small-to-medium operations prevalent in Iowa, large-scale production units are likely to command an increasingly greater share of Iowa's pork production if it is to maintain its dominant position.

## Survey Results

A survey was conducted in spring of 1993 to better understand how Iowa producers are participating in, and reacting to, these trends in the hog industry and the

Table 1.
*Demographic Profile of Pork Producers Surveyed, 1993*

| Item | Average | Minimum | Maximum |
|---|---|---|---|
| Operator Age | 45 | 25 | 77 |
| Years of hog experience | 22 | 2 | 60 |
| Years education | 13 | 8 | 20 |
| 1992 Market hogs sold | 1,743 | 0 | 22,325 |
| 1992 Feeder pigs sold | 447 | 0 | 12,950 |
| Number of sows | 128 | 0 | 1,300 |

implications for agribusinesses in rural communities. The survey focused on production, marketing, input purchasing decision, condition of facilities, future plans and opinion on key issues (Lawrence et al.). A mail survey was sent to a random sample of 1,000 Iowa pork producers identified by Iowa Agricultural Statistics. The sample was stratified by the nine state crop reporting districts. A follow-up post card reminder was sent to producers who had received the survey by mail. To ensure proportional response rates, the larger producers in the sample were telephone interviewed. Usable responses were collected from 344 producers. A profile of respondents is summarized in Table 1.

The survey results relating to hog producers' input purchasing patterns, their decision to bypass the nearest supplier, and reasons for bypassing were of particular interest to our study of rural community impacts. These results, summarized in Tables 2-4, profile the input purchasing patterns of Iowa hog producers, broken out by size. Three size ranges, based on hogs marketed per year, were used to classify operations: (a) less than 700 hogs, (b) between 701 and 2,000 hogs and (c) more than 2,000 hogs. This classified scheme resulted in three relatively equal groups of 113, 141 and 90 farmers in the small, medium and large categories. The overall most common source of farm inputs to the hog industry for all sizes of producers still appears to be retail outlets. A higher proportion of the feed and supplement supplies appears to be coming from local retailers than from other supplier categories (Table 2). In general, as operations increase in size, they tend to buy less at retail and buy more at wholesale or factory direct.

The survey results also indicate that many producers travel relatively long distances to buy inputs (Table 3), and a sizeable share of existing hog producers are willing to bypass the nearest source for their input purchases (Table 4). Purchasing patterns based on distance traveled to buy inputs varied somewhat by category of input

Table 2.
*Source of Purchased Inputs by Size of Hog Operation*

| Input and Source | Percent of Operations by Size | | | |
|---|---|---|---|---|
| | Small | Medium | Large | All Operations |
| Feed | | | | |
| Retail | 58.2 | 55.9 | 39.5 | 52.1 |
| Sales Representative | 28.6 | 27.6 | 23.3 | 26.7 |
| Wholesale | 8.2 | 9.5 | 15.1 | 10.6 |
| Factory Direct | 5.1 | 7.1 | 22.1 | 10.6 |
| Supplements | | | | |
| Retail | 56.4 | 48.5 | 42.5 | 49.4 |
| Sales Representative | 31.7 | 35.3 | 20.7 | 30.2 |
| Wholesale | 6.7 | 11.0 | 17.2 | 11.4 |
| Factory Direct | 5.0 | 5.2 | 19.5 | 9.0 |
| Veterinary Supplies | | | | |
| Retail | 87.5 | 70.4 | 56.5 | 72.2 |
| Sales Representative | 5.8 | 17.0 | 9.4 | 11.4 |
| Wholesale | 5.8 | 9.6 | 31.8 | 14.2 |
| Factory Direct | 1.0 | 3.0 | 2.4 | 2.2 |
| General Supplies | | | | |
| Retail | 85.7 | 83.1 | 80.9 | 83.3 |
| Sales Representative | 5.7 | 12.5 | 4.5 | 8.2 |
| Wholesale | 7.6 | 2.9 | 14.6 | 7.6 |
| Factory Direct | 1.0 | 1.5 | 0 | 0.9 |
| Hog Equipment | | | | |
| Retail | 76.7 | 56.9 | 40.2 | 58.7 |
| Sales Representative | 9.7 | 23.1 | 20.7 | 18.1 |
| Wholesale | 9.7 | 9.2 | 18.4 | 11.9 |
| Factory Direct | 3.9 | 10.8 | 20.7 | 11.3 |
| Building Supplies | | | | |
| Retail | 85.4 | 68.9 | 68.5 | 74.1 |
| Sales Representative | 8.7 | 19.7 | 14.6 | 14.8 |
| Wholesale | 2.9 | 10.6 | 15.7 | 9.6 |
| Factory Direct | 2.9 | 0.8 | 1.1 | 1.5 |

Table 3.
*Distance in Miles From Operation Inputs Purchased by Size of Hog Operation*

| Input and Miles | Percent of Operations by Size | | | |
| --- | --- | --- | --- | --- |
| | Small | Medium | Large | All Operations |
| **Feed** | | | | |
| 10 and less | 68.8 | 62.0 | 41.7 | 59.1 |
| 11 - 25 | 21.1 | 21.9 | 34.5 | 24.8 |
| 26 - 49 | 2.8 | 5.8 | 9.5 | 5.8 |
| 50 or more | 4.6 | 5.8 | 10.7 | 6.7 |
| Didn't buy | 2.8 | 4.4 | 3.6 | 3.6 |
| **Supplement** | | | | |
| 10 and less | 66.4 | 58.3 | 46.0 | 57.7 |
| 11 - 25 | 23.6 | 25.9 | 33.3 | 27.1 |
| 26 - 49 | 4.6 | 7.2 | 4.6 | 5.7 |
| 50 or more | 5.5 | 5.0 | 12.6 | 7.1 |
| Didn't buy | 0.0 | 3.6 | 3.5 | 2.4 |
| **General Supplies** | | | | |
| 10 and less | 59.3 | 54.7 | 44.3 | 53.4 |
| 11 - 25 | 36.1 | 40.2 | 50.0 | 41.4 |
| 26 - 49 | 4.6 | 4.4 | 3.4 | 4.2 |
| 50 or more | 0.0 | 0.0 | 2.3 | 0.6 |
| Didn't buy | 0.0 | 0.7 | 0.0 | 0.3 |
| **Hog Equipment** | | | | |
| 10 and less | 42.7 | 30.6 | 14.8 | 30.8 |
| 11 - 25 | 38.2 | 31.3 | 40.7 | 36.0 |
| 26 - 49 | 10.9 | 23.1 | 9.9 | 15.7 |
| 50 or more | 2.8 | 13.4 | 34.6 | 16.6 |
| Didn't buy | 0.9 | 1.5 | 0.0 | 0.9 |
| **Building Supplies** | | | | |
| 10 and less | 49.1 | 46.6 | 27.6 | 42.5 |
| 11 - 25 | 35.7 | 37.6 | 48.3 | 39.8 |
| 26 - 49 | 9.8 | 7.5 | 9.2 | 8.7 |
| 50 or more | 2.7 | 8.3 | 11.5 | 7.2 |
| Didn't buy | 2.7 | 0.0 | 3.5 | 1.8 |
| **Banking Services** | | | | |
| 10 and less | 65.5 | 70.2 | 56.7 | 65.1 |
| 11 - 25 | 34.5 | 23.4 | 33.3 | 29.6 |
| 26 - 49 | 0.0 | 5.7 | 8.9 | 4.7 |
| 50 or more | 0.0 | 0.0 | 0.0 | 0.0 |
| Didn't buy | 0.0 | 0.7 | 1.1 | 0.6 |
| **Accounting Services** | | | | |
| 10 and less | 42.6 | 45.6 | 26.7 | 39.5 |
| 11 - 25 | 29.6 | 36.0 | 47.8 | 37.1 |
| 26 - 49 | 6.5 | 11.8 | 7.8 | 9.0 |
| 50 or more | 3.7 | 2.2 | 14.4 | 6.0 |
| Didn't buy | 17.6 | 4.4 | 3.3 | 8.4 |

Table 4.
*Reasons by Size of Hog Operation for Not Using Nearest Supplier of Input*

| Input and Reasons | Percent of Operations by Size | | | |
| --- | --- | --- | --- | --- |
| | Small | Medium | Large | All Operations |
| *Always use nearest* | | | | |
| No | 54.5 | 62.4 | 79.8 | 64.3 |
| Yes | 45.5 | 37.6 | 20.2 | 35.7 |
| *If not using the nearest, why not?* | | | | |
| Feed | | | | |
| Price | 39.1 | 41.7 | 39.6 | 40.3 |
| Quality | 26.1 | 40.0 | 47.2 | 38.4 |
| Service | 34.8 | 18.3 | 13.2 | 21.4 |
| Supplement | | | | |
| Price | 43.2 | 53.3 | 43.1 | 47.1 |
| Quality | 31.8 | 25.0 | 45.1 | 33.5 |
| Service | 25.0 | 21.7 | 11.8 | 19.4 |
| Veterinary Supplies | | | | |
| Price | 44.2 | 41.4 | 41.1 | 42.0 |
| Quality | 11.6 | 15.7 | 28.6 | 18.9 |
| Service | 44.2 | 42.9 | 30.4 | 39.1 |
| General Supplies | | | | |
| Price | 63.3 | 63.6 | 67.9 | 64.9 |
| Quality | 20.4 | 16.7 | 20.8 | 19.0 |
| Service | 16.3 | 19.7 | 11.3 | 16.1 |
| *If not using the nearest, why not?* | | | | |
| Hog Equipment | | | | |
| Price | 51.9 | 46.3 | 42.6 | 46.8 |
| Quality | 32.7 | 38.8 | 40.7 | 37.6 |
| Service | 15.4 | 14.9 | 16.7 | 15.6 |
| Building Supplies | | | | |
| Price | 62.8 | 51.5 | 44.2 | 52.7 |
| Quality | 17.7 | 34.8 | 38.6 | 30.8 |
| Service | 19.6 | 13.6 | 17.3 | 16.6 |
| Banking Services | | | | |
| Price | 23.3 | 11.3 | 19.1 | 17.0 |
| Quality | 11.6 | 12.9 | 33.3 | 18.4 |
| Service | 65.1 | 75.8 | 47.6 | 64.6 |
| Accounting Services | | | | |
| Price | 20.6 | 6.7 | 6.0 | 9.7 |
| Quality | 20.6 | 33.3 | 54.0 | 37.5 |
| Service | 58.5 | 60.0 | 40.0 | 52.8 |

purchases. Larger-sized operations appear to be more willing to travel longer distances to purchase inputs than were producers with smaller operations. Not surprisingly, the survey results indicated a higher share of the bulkier inputs, such as feed and supplements, were purchased from closer sources (Table 3). Other inputs, such as professional services and equipment, were often purchased from sources further away than ten miles.

Seventy percent of the small producers compared to 43 percent of the large producers buy feed supplies within ten miles of their operation. Similarly, 20 percent of the large producers versus 7.5 percent of the smaller producers were willing to travel more than twenty-five miles for feed supplies. Some of this differential in purchasing patterns can be explained by the larger operations being located in more remote areas. However, a separate question indicates a higher percentage of the larger producers acknowledged bypassing the nearest input supply source. Eighty percent of the large versus 62.4 percent and 54.5 percent, respectively, of the medium and smaller operations bypass the nearest input supplier (Table 4).

For categories of inputs that do not require heavy hauling, such as accounting services, equipment, and veterinary and general supplies, a majority of large producers chose to travel more than ten miles while the small and medium producers more frequently chose sources within ten miles. Banking appears to be one service for which primarily local sources were used by operations of all sizes. However, the larger operations again had a proportionally larger share of the operators going longer distances for banking services. For producers who indicated they did not buy inputs in the nearest community, quality and service were most frequently given as the reasons when professional services such as accounting, banking and veterinary were involved (Table 4). Pricing is a more dominant factor in producer decisions to purchase general supplies and hog equipment. Producer concerns with both price and non-price attributes of inputs and services for hog production suggest that local agribusinesses in rural communities are likely to face increased competitive pressures from larger and more distant businesses.

## Analysis of Decision to Bypass Local Agribusinesses

The survey of Iowa hog producers indicated that producers were willing to travel relatively long distances to purchase their inputs and that a sizeable percentage were bypassing the nearest available supply source. The statistics on the changing characteristics of producers in the hog industry implies that new producers are entering the business or that existing producers are changing their methods of operation. These changing production patterns suggest that the traditional relationship between producers and agribusinesses in rural areas are undergoing significant changes as well. An analysis of the factors associated with the choice of producers to bypass local suppliers can provide information on the type of agribusinesses and communities that

Table 5.
*Variable definitions.*

| Variable | Value | Definition |
|---|---|---|
| YRSEXP | mean = 22.38<br>std. = 11.55 | The producers years of experience in pork production |
| YRSEDU | mean = 13.20<br>std. = 2.15 | Years of formal education that the producer has completed |
| OFFARM | n = 57<br>n = 287 | 1 if part-time or full-time off farm employment; 0 otherwise |
| ACCT | n = 172<br>n = 170 | 1 if the producer uses an accountant; 0 otherwise |
| NUTC | n = 148<br>n = 193 | 1 if the producer uses an nutritional consultant; 0 otherwise |
| IPPA | n = 204<br>n = 137 | 1 if the producer was a member of the Iowa Pork Producers |
| FINFC | n = 101<br>n = 243 | 1 if the producer financed facilities in 1992; 0 otherwise |
| SHARE1 | n = 122 | 1 if hogs are 26%-50% of total receipts; 0 otherwise |
| SHARE2 | n = 93 | 1 if hogs are 51%-75% of total receipts; 0 otherwise |
| SHARE3 | n = 53 | 1 if hogs are 76%-100% of total receipts; 0 otherwise |
| SHARE[a] | n = 71 | Operators with 0%-25% of total receipts from pork production (null category) |
| TOTPROD | mean = 2012<br>std. = 2959 | Total pork production in head |
| TOTINC1 | n = 113 | 1 if total receipts is $100,000-$250,000; 0 otherwise |
| TOTINC2 | n = 138 | 1 if total receipts is $250,000 or over; 0 otherwise |
| TOTINC[a] | n = 49 | total receipts under $100,000 (null catagory) |
| CALCOST | n = 177 | 1 if the producer is able to calculate his/her cost of production n = 163 per cwt; 0 otherwise |

[a] null category

are likely to be adversely affected as the structure of the hog industry changes. This section presents results of a multi-variate logit model examining factors associated with the choice of producers to bypass a local source for input supplies.

The decision of hog producers to bypass their local community for purchasing inputs is hypothesized to be related to the enterprise characteristics, personal characteristics of the producer, and the characteristics of the community or supply center (Table 5). These determinants are expected to be similar for the eight different hog-related inputs examined in this study. Since the survey did not collect data on addresses of producers, demographic data on community characteristics and the location of agribusinesses could not be matched. Our approach around this limitation is to ask whether the producer is bypassing the nearest source of an input. Producers who are situated near quality supply services and are satisfied with the value of those services would not be expected to bypass a nearby vendor. Of the personal and professional characteristics for which data has been collected, size of the producer's operation, education level and degree of professionalism and specialization are expected to be positively related to the choice to bypass the nearest input supplier. Relatively younger farmers rather than older, more established producers were expected to be more likely to bypass local suppliers. Therefore, age and years of experience were expected to be negatively related to the bypass decision. is to ask whether the producer is bypassing the nearest source of an input. Producers who are situated near quality supply services and are satisfied with the value of those services would not be expected to bypass a nearby vendor. Of the personal and professional characteristics for which data has been collected, size of the producer's operation, education level and degree of professionalism and specialization are expected to be positively related to the choice to bypass the nearest input supplier. Relatively younger farmers rather than older, more established producers were expected to be more likely to bypass local suppliers. Therefore, age and years of experience were expected to be negatively related to the bypass decision.

A producer's decision whether to bypass the nearest available choice for a production input can be characterized as a dichotomous (yes or no) question. Several modeling options are available for analyzing yes-no situations such as this. Treating the response option as a 0,1 dummy dependent variable, as in a linear probability analysis, has been shown to result in inefficient and biased estimates of parameters (Amemiya; Pindyck and Rubinfeld). Logit and probit models are commonly used methods of estimating parameters in a dichotomous choice situation. Although the underlying distribution function in the probit and logit models are similar, the logit model has been applied to dichotomous choice issues more frequently because it is computationally more tractable (Amemiya; Pindyck and Rubenfeld). Accordingly, the logit model is used in the present study.

Following this logit probability model, the probability ($P_i$) that a producer will bypass the nearest source for a service or input is given by:

$$P_i = F(Z_i) = \frac{e^{Z_i}}{1+e^{Z_i}} = \frac{1}{1+e^{-Z_i}}$$

$$-\infty < Z_i < \infty \quad where \quad Z_i = X_i'B$$

(1)

where $f(Z_i)$ is the value of the density function associated with each value of the $Z_i$ index (Pindyck and Rubenfeld). The change in probability is evaluated at the mean from a one unit change of the variable, $X_i$. A producer's decision to bypass is influenced by $X$, a vector that includes the set of personal and professional characteristics. B is the associated set of parameters to be estimated. There is no universally accepted measurement of goodness of fit for logit models (Caffey and Kazmierczak). The McFadden $R^2$ is a pseudo-$R^2$ commonly used (Muddala), but may be difficult to interpret because it is not restricted to (0,1). The McFadden $R^2$ values in the range of .2 to .4 are common for logit models (Sonka, Wetzstein and Douce).

The hypothesized model used to explain purchasing pattern is similar for each input. Specifically the decision by producers to bypass the nearest source for an input can be expressed as:

$$BYPASS_i = f(TOTPROD, TOTINC, SHARE, YRSEXP, \qquad (2)$$
$$YRSEDU, ACCT, OFFARM, CALCOST)$$

where $BYPASS_i$ is the decision to bypass the nearest supplier for the ith input. The other variables and their summary statistics are defined in Table 5. The percentage of right predictions is calculated based on the resulting probability from the model of an individual producer, compared to his or her response. The predicted result will be a number in the range 0,1 with greater than .5 a prediction of decision to bypass the nearest input supplier. Under .5 predicts the use of the nearest supplier. These results are then checked against survey results to test the model's predictive ability.

## Statistical Results

Similar models were specified for all eight categories of inputs studied. The coefficients for the logit model were estimated using SHAZAM (White) with the results of the logit estimates summarized in Table 6. The percentage of right predictions, a goodness-of-fit measure, ranges from 66 percent to 72 percent for the different inputs. This statistic indicates that producers are correctly classified regarding their bypass decision about 66 percent to 72 percent of the time. The Mc-Fadden $R^2$ values range from .125 to .155, which is not an unusually small percentage for equations based on cross-sectional data such as in our survey. However, the log

Table 6.
*Logistic Regression Results.*

| | Feed | Supplements | Hog Supplier | General Suppliers | Banking | Accounting | Hog Equipment | Building |
|---|---|---|---|---|---|---|---|---|
| Inter | -1.279 | 1.409 | -3.067*** | -1.750 | -2.407** | -2.977*** | -2.086* | -2.180* |
| | (1.163) | (1.161) | (1.225) | (1.141) | (1.194) | (1.259) | (1.158) | (1.146) |
| YRSEXP | -0.041*** | -0.035*** | -0.034*** | -0.031*** | -0.032*** | -0.029** | -0.031*** | -0.027** |
| | (0.014) | (0.013) | (0.013) | (0.013) | (0.014) | (0.014) | (0.013) | (0.013) |
| YRSEDU | 0.106 | 0.098 | 0.200*** | 0.130* | 0.146* | 0.194*** | 0.156** | 0.158** |
| | (0.074) | (0.073) | (0.078) | (0.074) | (0.077) | (0.080) | (0.074) | (0.074) |
| OFFARM | -0.532 | -0.514 | -0.096 | -0.373 | -0.318 | -0.532 | -0.418 | -0.540 |
| | (0.450) | (0.456) | (0.434) | (0.432) | (0.445) | (0.472) | (0.430) | (0.429) |
| ACCT | 0.523* | 0.367 | 0.301 | 0.425 | 0.653** | NA | 0.410 | 0.575* |
| | (0.317) | (0.321) | (0.311) | (0.303) | (0.311) | NA | (0.301) | (0.301) |
| SHARE1 | -0.320 | -0.372 | 0.074 | -0.265 | 0.034 | -0.099 | -0.173 | 0.036 |
| | (0.429) | (0.433) | (0.414) | (0.412) | (0.430) | (0.443) | (0.412) | (0.412) |
| SHARE2 | -0.511 | -0.559 | -0.271*** | -0.502 | -0.104 | -0.193 | -0.319 | -0.200 |
| | (0.508) | (0.510) | (0.500) | (0.494) | (0.512) | (0.521) | (0.496) | (0.494) |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SHARE3 | -0.430 | -0.305 | 0.052 | -0.268 | -0.012 | -0.177 | -0.328 | -0.345 |
| | (0.657) | (0.644) | (0.641) | (0.629) | (0.655) | (0.674) | (0.640) | (0.643) |
| TOTPROD | $0.27 \times 10^{-3}$* | $0.27 \times 10^{-3}$* | $0.26 \times 10^{-3}$* | $0.24 \times 10^{-3}$* | $0.20 \times 10^{-3}$* | $0.26 \times 10^{-3}$* | $0.25 \times 10^{-3}$* | $0.25 \times 10^{-3}$* |
| | $(0.15 \times 10^{-3})$ | $(0.15 \times 10^{-3})$ | $(0.15 \times 10^{-3})$ | $(0.14 \times 10^{-3})$ | $(0.13 \times 10^{-3})$ | $(0.14 \times 10^{-3})$ | $(0.14 \times 10^{-3})$ | $(0.15 \times 10^{-3})$ |
| TOTINC1 | 1.185*** | 1.339*** | 1.308*** | 1.108*** | 1.225*** | 1.117*** | 1.102*** | 0.858** |
| | (0.460) | (0.478) | (0.465) | (0.446) | (0.453) | (0.475) | (0.436) | (0.421) |
| TOTINC2 | 0.299 | 0.579 | 0.598 | 0.494 | 0.565 | 0.226 | 0.414 | 0.105 |
| | (0.555) | (0.566) | (0.545) | (0.526) | (0.543) | (0.573) | (0.525) | (0.522) |
| CALCST | -0.363 | 0.297 | 0.459 | 0.320 | 0.285 | 0.493 | 0.355 | -0.363 |
| | (0.345) | (0.342) | (0.328) | (0.328) | (0.333) | (0.337) | (0.323) | (0.326) |
| McFadden $R^2$ | 0.154 | 0.147 | 0.155 | 0.132 | 0.139 | 0.151 | 0.130 | 0.125 |
| Log Likelihood Function | -130.18 | -128.29 | -133.64 | -136.84 | -128.43 | -125.18 | -139.02 | -137.97 |
| Percentage of right predictions | 69.3 | 70.0 | 72.1 | 68.1 | 65.9 | 71.0 | 68.2 | 66.4 |

* $\alpha = .10$
** $\alpha = .05$
*** $\alpha = .01$
Values in parentheses are standard errors.

likelihood ratios are highly significant, indicating that the amount of the variation explained by the equations were significantly different from zero.

The individual parameter estimates represent marginal changes in the probability ($P_i$) that a producer will bypass a local supplier. The standard errors and critical values provide an indication of the relative significance of the different independent variables in affecting the decision by producers to bypass their nearest supply source. Elasticities can be calculated for the change in probability of bypassing with respect to changes in the independent variables using the SHAZAM output. For example, at mean levels, the elasticity associated with the years of experience variable (YRSEXP) is .0097 which means that for a ten percent increase in years of experience, there is approximately a one percent change in the probability that a farmer would bypass the nearest supplier. This elasticity calculation is meaningless for the discrete categorical variables. The variables used in the model are organized so that positive coefficients indicate that higher values in the independent variables or a "yes" response will result in a higher index $Z_i$ value and a higher probability of bypassing the nearest agricultural suppler.

Although producers in all size categories were willing and able to travel considerable distances for their inputs, our study indicated that operators of larger-scaled hog enterprises were more likely to bypass local vendors. Size of operation as measured by total hogs produced (TOTPROD) was significantly and positively related to the decision to bypass a local supply source. Total gross farm sales (TOTINC), including revenues other than hogs, was also positively related to this bypass decision. Farmers with gross sales in the $100,000 to $250,000 range were significantly more likely to bypass local vendors than those farms in the smaller gross sales category. While those farmers in the over $250,000 category of sales also were likely to bypass nearby communities, the difference was not significant. The reasons the mid-size-sales-range group stands out may be because these farmers have not contracted with suppliers and are willing to shop around for values. Also, the larger operations may be better able to extract price concessions for larger volume from local suppliers.

Years of experience in the hog business (YRSEXP) was negatively related to the decision to bypass a local supplier of inputs. Since years of experience is highly correlated with age of the farmer, this pattern suggests that older farmers with more years in the community have developed a relationship with local vendors and are less likely to bypass a traditional supply source in their local community. Younger producers with fewer years of experience in the hog industry have not developed long-term professional relationships with local vendors and are less reluctant to bypass local sources if they perceive better prices and service available elsewhere.

In equations for several of the service-related inputs (banking, accounting, general supplies), level of education also appears to be an important factor in the decision of producers to bypass a local supply source. Years of education (YRSEDU) is significantly and positively related to the decision to bypass a local supplier for the purchase of all services and inputs except feed supplies.

Several measures of technical proficiency of hog producers, including being able to calculate cost (CALCOST) of production, use of advanced genetic systems, special swine management practices, and use of an accountant (ACCT) were tested for a relationship to the bypass decision. Only the variable identifying use of an accountant (ACCT) by producers was significantly related to the decision to bypass a local supplier for the different inputs. The use of an accountant is probably not the important factor in the choice, but rather the size and type of operation and business attitude of producers who tend to use an accountant that is then associated with the decision to bypass local suppliers.

Several other factors that were expected to influence producers' decisions to bypass local suppliers were not significant in our tests. Specialization in hog production (SHARE) as measured by the percentage of farm marketings from hogs and off-farm employment (OFFARM), which indicates a focus on farm-related activities, was not significant in any of the regression models of the hog input purchasing decisions.

In general, the results indicate that producers who are more likely to bypass a local supply source for their hog-related inputs have larger operations, higher levels of education, relatively fewer years of experience in the hog business, and take a more businesslike approach to hog production. These results are consistent with the cross tabulation of Tables 2-4, but with the added information on the significance of the relationships.

## Summary and Conclusion

The results from this analysis pose serious concerns for agribusiness and communities in rural areas. The results of the survey and the logit analysis indicate a strong relationship between size of hog operation and the tendency to travel long distances for inputs and to bypass local suppliers. The profile of the type of producer most likely to bypass the nearest input supply source matches the profile of the dominant producer emerging in the pork industry. These producers are younger, more specialized, larger-scaled, and use more professional practices. To the detriment of some smaller rural businesses and communities, these are also the type of producers most likely to bypass supply sources in nearby communities and focus purchasing in trade centers. Reasons given for choosing to bypass included quality of inputs and service from provider as well as input price.

Although our study indicated that producers with larger operations were more likely to bypass the nearest vendor, producers in all size ranges indicated a willingness to travel considerable distances to purchase inputs. Quality and service were the most frequently cited reasons for bypassing the nearest vendor of professional services such as banking, accounting and veterinary. Pricing became a more dominant factor in producer decisions to purchase feed, general supplies and hog equipment.

Producer concerns with both price and non-price attributes of inputs and services for hog production suggest that local agribusinesses in rural communities are likely to face increased competitive pressures from larger and more distant businesses. Rural agribusinesses will continue to undergo structural changes that mirror the changes occurring in the hog industry as well as in agriculture in general. Customers are going to be fewer, larger, more specialized, and more demanding. Rural agribusinesses that are unable to provide specialized expertise will have difficulty competing in this environment. In turn, the loss of agribusiness firms in the smaller communities will exacerbate employment and income situations in the more remote, agriculturally dependent rural areas. Agribusinesses that are able to provide the quality, service and price that emerging pork operations demand will be able to draw from a relatively large trade area. In addition, the volume of purchases made by the larger producers will be larger on average than in the past. By causing agribusinesses to be more market conscious and price competitive, rural area farmers may be able to benefit from these changes even though there may be fewer agribusiness firms.

The institutional organization of hog production may be as important as size of the operation in affecting linkages to local agribusiness and rural economies. Externally owned corporate facilities may be less likely to consider local community impacts of their purchasing patterns. Gillespie and Fulton suggest that community-based hog production systems are more likely to be integrated into the local economy than large-scale, externally financed facilities. While larger operations may contract directly for certain inputs and services such as veterinary and banking, transportation costs for feed grains suggest these purchases will be local. Large-scale producers may diversify their feed grain purchases among several suppliers in order to avoid price effects. Further research is needed on the implications of ownership structure for purchasing patterns and impacts to rural areas.

Input suppliers to hog operations in rural communities face a shrinking market if they cannot adapt to the needs of large producers. However, if younger, better-educated producers with a more businesslike approach to hog production do not have access to quality inputs and services at competitive prices, hog production may have difficulty remaining competitive in the local area. Less hog production will use less labor, management and other locally provided inputs such as grain and utilities while generating fewer local taxes. The reduced wage and salary income will directly impact purchases of consumer goods from nonagricultural retail businesses. Thus, rural businesses, in addition to those producing agricultural input supplies, and rural communities will be affected by changes in the pork industry.

### Notes

*John D. Lawrence is Assistant Professor, Daniel Otto is Professor, and Seth Meyer is a graduate student in the Department of Economics, Iowa State*

## References

Amemiya, Takeshi. *Advanced Econometric.* Cambridge, MA: Harvard University Press, 1985.

Caffey, R.H., and R.F. Kazmierczak, Jr. "Factors Influencing Adoption in a Louisiana Aquaculture System." *J. Agr. App. Econ.* 26(1994):264-274.

DiPietre, Dennis, and Carl Watson. *The Economic Effect of Premium Standard Farms on Missouri.* University Extension Commercial Agriculture Program Bull. CA 144, University of Missouri, July, 1994.

Fulton, J., and J. Gillespie. "Emerging Business Organizations in a Rapidly Changing Pork Industry." *Amer. J. Agr. Econ.* 77(1995):1219-1224.

Hogeland, Julie A. *The Role of Local Cooperatives in the Emerging Swine Industry.* Washington, DC: USDA Rural Business and Cooperative Development Service Research Rep. 144, Nov. 1995.

Kimle, Kevin, and Marvin Hayenga. *Agricultural Input and Processing Industries.* Agricultural and Home Economics Experiment Station and Cooperative Extension Service RD-05. Ames, IA: Iowa State University, Apr. 1992.

Lawrence, John, Daniel Otto, Seth Meyer and Steven Folkerts. "A Profile of the Iowa Pork Industry, Its Producers and Implications for the Future." Dept. of Econ. Staff Pap. 253. Ames, IA: Iowa State University, June 1994.

Muddala, G.S. *Limited-Dependent and Qualitative Variables in Econometrics.* Cambridge, England: Cambridge University Press, 1983.

Otto, Daniel, and John Lawrence. *Economic Impact of the U.S. Pork Industry.* Des Moines, IA: National Pork Producers Council, 1994.

Pindyck, Robert S., and Daniel L. Rubinfeld. *Econometric Methods and Economic Forecasts,* 2nd ed. New York, NY: McGraw Hill Book Company, 1981.

Sonka, G.S., M.E. Wetzstein and G.K. Douce. "Evaluation of Various Pest Management Characteristics." *South. J. Agr. Econ.* 19(1989):39-47.

St. Clair, Cheryl F., Gerald A Doeksen, Stan Ralstin and Steve Kraich. *The Economic Impact of a Pork Processing Plant on the City of Guymon and Texas County, Oklahoma.* Oklahoma Cooperative Extension Service Rural Development, AE Paper 9440. Stillwater, OK: Oklahoma State University, Sept. 1994.

White, Kenneth J. "SHAZAM: A General Computer Program for Econometric Methods," version 6.0. *Amer. Statistician* 41(1987):80.

U.S. Census Bureau. U.S. Department of Commerce. Washington, DC: National Agricultural Statistics Service, various years.