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Abstract

Factors influencing farmer selection of a crawfish marketing outlet were analyzed using 2008 survey data from the Louisiana crawfish industry. Most farmers sell directly to wholesalers. Probit results show farm size, farm income, household income, age, education, and pre-market grading and washing operations significantly affecting farmer selection of an outlet.

Key Words: Crawfish, Marketing Outlet, Premarket Practices, Probit.

Introduction

Farmers choose a market outlet considering its convenience and economic profitability. Louisiana has a significant aquaculture industry with crawfish production as a major enterprise. Although Louisiana is the largest crawfish producer in the United States with almost 1,600 farms on more than 184,000 acres (LSU AgCenter, 2008), most of the state's production (70%) is consumed in Louisiana and neighboring states, whereas much of the remaining U.S. demand has been supplied via the world food market, especially from China (Lee, 2007). In 2002, Louisiana per capita consumption was far higher (10.4 lbs) than that of the rest of U.S. (0.25 lbs) (Lee,

2007). Restricted geographical production areas, seasonal production, and unstable prices are among the most significant reasons for the limited national supply of crawfish (McClain et al., 2007). Moreover, the U.S. crawfish industry has to compete with tail-meat from China which is priced lower than the domestic product (Lewis and Gillespie, 2008).

Crawfish is sold in the U.S. market mainly in two forms: whole and live or as peeled tail-meat. The harvesting schedule and market distribution of crawfish is highly influenced by its short shelf life (Romaine et al., 2005). Peeled tail-meat can be sold in fresh or frozen form. All of the whole and live crawfish and most of the fresh tail-meat are provided by domestic producers while China is the major supplier of frozen tail-meat. Thus, the increased imports of frozen tail-meat would ultimately result in serious loss to the decreasing number of domestic crawfish processors (Lee, 2007). Developing an understanding of all facets of the production, marketing, and distribution of crawfish to consumers is important if the industry is to regain competitiveness with its foreign competitors.

Little is known about the effect of crawfish producers' demographic and farm characteristics on their marketing decisions. Furthermore, we have not identified previous research on premarketing production practices in relation to the selection of a marketing outlet. These practices could be a topic of significant interest in analyzing the relationship between consumer preferences, management practices and technology adoption. Several premarketing practices could have direct impact on the quality of crawfish, as well as the price obtained by the farmer for crawfish. The objectives of this study are to assess the current pattern of crawfish producers' choice of a marketing outlet, and to determine the effects of farm production, demographic and pre-selling practices on crawfish producers' marketing decisions. We use data from a mail survey conducted with Louisiana crawfish producers in Fall, 2008. This study

provides some background information about crawfish marketing, discussion of data and methods used, results, and finally conclusions.

Premarketing Practices and Methods of Crawfish Marketing

Although crawfish is not considered to be a staple food, boiled crawfish is very common among springtime social occasions in Louisiana, especially on weekends. A farmer may sell crawfish directly to a consumer, processor, primary wholesaler, or retailer depending upon access to the market and production practices used (McClain et al., 2007). Producers generally sell crawfish live to one of these outlets. The primary wholesaler can then sell the product again to retailers, processors, and/or consumers. When there is market saturation, size grading is a commonly used practice, allowing uniform-sized crawfish to be distributed to the target marketing unit. The structure of crawfish marketing outlets is provided in Figure 1. Larger crawfish have higher appeal for crawfish boils, so consumers generally purchase them live, whether directly from the farmer or from a primary wholesaler. Smaller-sized crawfish are generally peeled by processors for sale as tail-meat. Usually, grading is done in wholesaler or processing units by using modified vegetable graders or custom-made graders (Romaine et al., 2005). External wash with ascorbic or citric acid is sometimes done to improve the market value of the product.

The practice of confining crawfish in water without food supplements for one or two days, termed “purging”, is one of the ways to increase market value of live crawfish. It helps to clean external mud, debris and excretory products from the intestine. Additional cost of 15-25% is expected for purging crawfish (Romaine et al., 2005). Value is added, but there is mortality risk associated with purging (McClain et al., 2007).

In areas where live crawfish is available, there are generally a number of small retail outlets and restaurants specializing in serving boiled crawfish. When the live crawfish market is saturated, smaller sized crawfish are processed for tail-meat production or sold to the processing industry, leaving large crawfish for live market. Some firms cater boiled crawfish to parties and festivals using custom boiling rigs, another marketing outlet for live crawfish (Romaine et al., 2005).

Because of lower priced tail-meat imports from China, a reduction of licensed processors from >100 to <30 has been observed in recent years; thus, the peeling capacity of the industry has decreased (McClain et al., 2007).

Data and Methods

The Survey

The adoption of four premarketing practices and the use of marketing outlets are assessed using crawfish producer responses obtained from a mail survey conducted during Late Summer – Early Fall, 2008, to 770 Louisiana crawfish producers who receive a crawfish newsletter sent by the LSU Agricultural Center. Dillman's Total Design Method (1978) was used for implementing the survey. An 8-page questionnaire accompanied with a personally signed request letter was sent by first-class mail. About 1 ½ weeks later, a postcard reminder was sent to all non-respondents. After the first postcard reminder, a second copy of the questionnaire and then a second postcard reminder were sent each in 1 ½ week intervals, thus making a total of four contacts with producers. Of the 770 who were sent surveys, 79 were returned as non-deliverable, 185 were sent back with the producer stating they did not produce crawfish during the 2007-2008 production season, and 75 were returned as completed surveys, thus resulting in an adjusted response rate of 15%.

Farmers were asked to choose any of the four marketing outlets applicable to their scenario. The choices include: “I sell to a processor,” “I sell to a wholesaler,” “I sell to a retailer,” and “I sell directly to consumers”. Following this, they were asked, “Do you, at least sometimes”: “Grade your crawfish prior to selling them?”, “Wash your crawfish prior to selling them?”, “Purge your crawfish prior to selling them?”, and “Own or run a commercial crawfish peeling operation?” The survey also included information on other crawfish production practices, farm characteristics, and farmers’ characteristics.

Econometric Model

Probit models are used to analyze factors influencing crawfish producers’ choice of marketing outlet. Marketing outlets (dependent variables) include whether the farmer markets crawfish via processors, wholesalers, retailers, and/or consumers. Using the probit model, which assumes a normal distribution, the probability of adoption is modeled as shown in Greene (2000):

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

where $\phi(\cdot)$ denotes the standard normal distribution, $(Y=1)$ suggests the marketing outlet was adopted, and x represents independent variables expected to influence adoption. Marginal effects for continuous variables are estimated as:

$$(2) \quad \frac{\partial E[Y|x]}{\partial x} = \phi(\beta'x)\beta$$

Marginal effects for dummy variables, d , are estimated as:

$$(3) \quad \Pr[Y = 1|\bar{x}_*, d = 1] - \Pr[Y = 1|\bar{x}_*, d = 0]$$

where \bar{x}_* refers to all variables other than d held at their mean values. Though we originally considered using the multivariate probit model to examine market choice among the four

marketing outlets similar to Fu et al. (1988), initial runs using the model suggested that the sample size was too small to support this framework.

Independent Variables

Farm Size and Diversification. Independent variables include *Acres* of land used in crawfish production, a measure of crawfish production. Higher production is expected to be associated with sales to the wholesaler and processor market because of their capacity to purchase in bulk. Moreover, they generally also have grading facilities in cases of oversupply. Percent of farm income from crawfish production (*%FarmCF*) shows the degree of specialization of a farm. Percent of household income from the farming operation (*%HHFarm*) allows for analysis of the influence of the farmer's financial dependence from farm operations on choice of market outlet. Since marketing direct to consumers or retailers is likely to require additional management on the part of the producer (scheduling, dealing with specific requirements, etc.), it is expected that producers who are more highly specialized in crawfish production will more likely market via those outlets. A farmer who is more economically dependent on agriculture is expected to use more innovative production and marketing practices. Fu et al. (1988) showed a relationship between the number of farm enterprises in which a peanut farmer was involved and market choice. Gillespie et al. (2004) and Davis and Gillespie (2007) found farm size and diversification variables to influence farmer choice of cattle marketing and hog market outlets, respectively.

Demographic. Previous marketing studies (e.g., Gillespie et al, 2004; Davis and Gillespie, 2007) have examined the influence of producer *Age* and education on adoption of a market outlet. We divide producer education into two categories, one without a high-school degree (*NoHighSch*), the other having at least a four-year *College* degree. The number of *Years* a

farmer has been farming crawfish is a continuous variable in increments of 7 years. This variable allows us to examine impact of experience on marketing outlet selection.

Production Practices. Two dummy variables, whether the producer *Grades* and/or *Washes* crawfish prior to selling, were included to determine the impact of premarketing practices on the selection of marketing outlets. Farmers who grade and/or wash crawfish prior to selling are expected to be more likely to sell directly to consumers; most processors have their own grading facilities (Gillespie and Lewis, 2005), so grading would not be as important in selling to them. The number of *Months* crawfish are produced annually is also likely to influence the marketing options farmers have available to them. Generally, the early harvesting season runs from November-January when most of the crawfish are immature, mid-season is February-May, and late season is June-July. The price is generally highest in early production season (winter and early spring) when the demand is highest, while it decreases in the peak season and late season when the supply of other seafood products such as shrimp and crabs increases (Romaine et al., 2005).

Results

General Overview of the Louisiana Crawfish Industry

Survey results provide a general overview of the Louisiana crawfish industry (Table 1). The average crawfish farm size is 211 acres. Although the mean percentage of farm income from crawfish and percentage of household income from farming were found to be in the 20-39% and 40-59% ranges, respectively, half of the population responded that their farm income generated from crawfish was <20%, while a range of percentage of household income from farming suggested wide diversity in that measure among farms. It is common for producers to rotate crawfish, rice and soybeans, or double-crop rice with crawfish. Furthermore, a typical producer

harvests crawfish for 5-6 months during the year (mean=5.6 months), leaving time for other activities during the remaining portion of the year. Of the respondents, 29.3% held college degrees, while only 6.6% did not hold a high school diploma. The modal range of age of producers was 46-60 years. The modal years of farming experience was 15-21 years.

Farmer Premarketing Operations and Selection of Marketing Outlets

Table 2 provides farmers' premarketing practices conducted before selling. Most of the respondents (62.5%) grade crawfish prior to selling. As mentioned earlier, smaller crawfish are more often used in tail-meat production, and thus have a possible route to processors. Compared to grading, the percentages of farmers washing (31.8%), purging (4.8%), or peeling (7.7%) prior to selling are lower. The lower inclination towards purging could be partly due to associated mortality risks and higher fixed cost. A peeling operation is generally conducted manually and would generally be considered a labor-intensive separate enterprise with extensive specific associated equipment.

Farmer selection of marketing outlets and their proportions are provided in Table 3. Most of the farmers (64.2%) chose wholesaler markets. Percentages of producers selling crawfish directly to consumers, retailers, and processors were 30.3%, 22.7%, and 17.9%, respectively. In the early harvesting season, small farmers are expected to sell their product to local consumers while most of the large producers sell directly to the primary wholesalers. After commercial grading in the wholesale market, large crawfish will be marketed for live crawfish boils while small sized crawfish are directed toward processing.

Probit Results of Farmers' Choosing a Marketing Outlet

Table 4 shows the factors affecting farmer choice of a crawfish marketing outlet. Larger farmers are found to be more likely to market via retail outlets, likely the result of needing to

guarantee significant volume to supply those markets. Farmers with college degrees are more likely to sell their product via wholesalers and less likely to market via processors. Those without high school diplomas are inclined towards processors and direct to consumers rather than the wholesaler market. As expected, farmers with higher portions of their farm income from crawfish are more likely to market crawfish direct to consumers. On the other hand, as expected, those with greater percentages of income coming from off-farm sources are more likely to market via wholesalers.

Farmer age is positively associated with selling crawfish to processors, while negatively related to selling to wholesalers. Producer grading of crawfish also has a positive relationship with the wholesale market, while producers washing crawfish are less likely to sell their product to wholesalers and more likely direct to consumers. Washing crawfish just after harvesting not only removes external debris, but also improves the quality by providing a cleaner looking product, so it is not surprising that washing would be done when marketing directly to the consumer. The wholesaler can sell crawfish to processors, retailers, or direct to consumers, so they may conduct grading and/or washing if not already done by the producers.

Summary and Conclusions

This paper deals with factors associated with crawfish farmers' use of alternative marketing outlets. We use 2008 survey data from the Louisiana crawfish industry. Four types of marketing outlets commonly used in the industry are analyzed using probit models. Although a farmer can choose a single outlet or a combination of outlets during a production season, the wholesale market was most commonly used in the industry. A total of 64.2% of the survey sample was found to sell to wholesalers, 30.3% sold directly to consumers, 22.7% to retailers, and 17.9% to processors. Understanding how crawfish are marketed is of importance when

examining ways in which an industry can regain its competitiveness with international competitors. From an international competitiveness standpoint, one would need to examine the transaction costs and market efficiency associated primarily with the wholesale market to determine whether appreciable increases in efficiency (reductions in the cost of getting crawfish to the final consumer) could be gained.

It was found that 62.5% of producers grade and 31.8% wash crawfish prior to selling. Purging is not frequently done by producers, and few producers are involved in the peeling segment. Increased mortality in purging and high costs associated with peeling are likely to be two major reasons for lower adoption of those value-added activities.

Younger farmers with higher percentages of household income from farming, with a college degree, and those who grade and do not wash crawfish are more likely to choose the wholesale market. Scale of operation was the major determinant as to whether farmers would sell directly to retailers, as larger farmers are the ones who have the volume required to sell directly to the retail market. Farmers who wash crawfish before selling and have higher percentages of their farm income coming from crawfish are the more likely farmers to market direct to consumers. Older, less highly educated farmers were more likely to market direct to processors. As expected, demographics, farm characteristics, and pre-market activities had significant influences on market choice.

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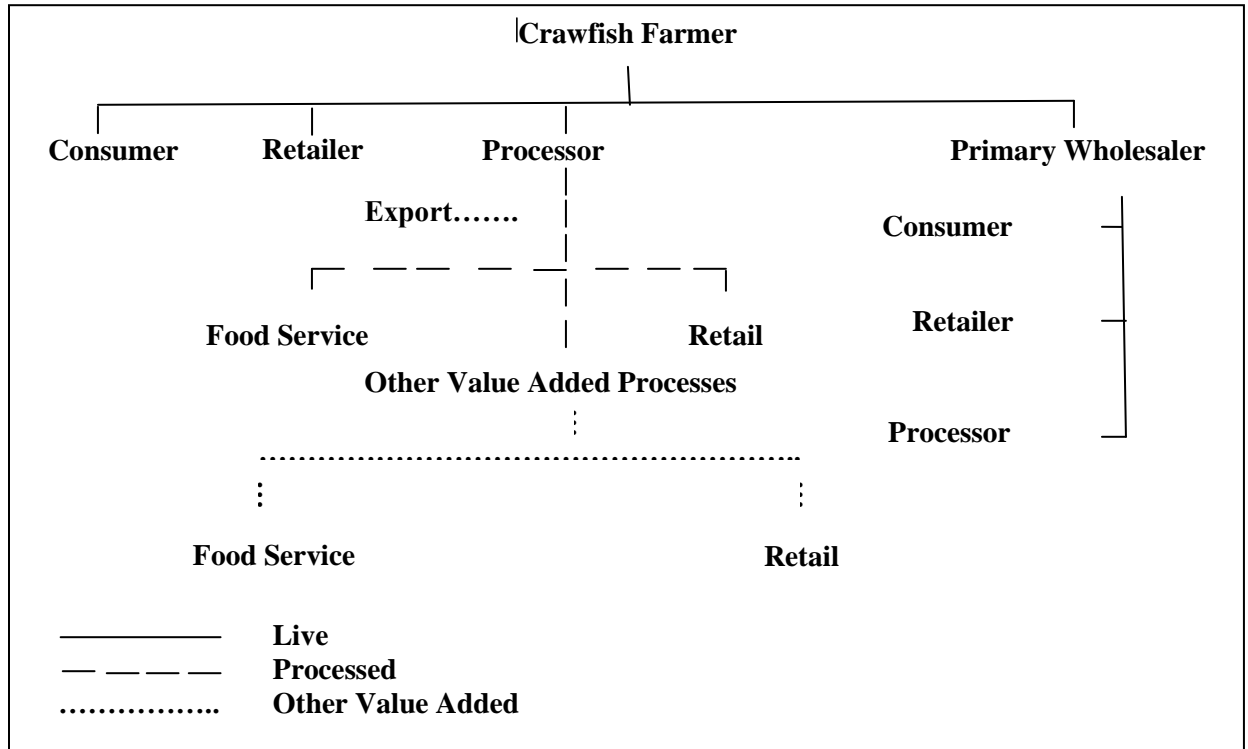


Figure 1: Marketing Outlets for Louisiana Crawfish; Source: Romaine et al., 2005.

Table 1: General Overview of the Crawfish Industry.

Independent Variables	Description	Mean
<i>Acres</i>	Cts: Number of acres on the farm	211.25
<i>%FarmCF</i>	Cts: Percent of farm income from the crawfish operation; 1: 1-19%; 2: 20-39%; 3: 40-59%; 4: 60-79%; 5: 80-100%	2.15
<i>%HHFarm</i>	Cts: Percent of household income from the farming operation; 1: 1-19%; 2: 20-39%; 3: 40-59%; 4: 60-79%; 5: 80-100%	3.03
<i>Age</i>	Cts: Farmer's age; 1: ≤ 30 years; 2: 31-45 years; 3: 46-60 years; 4: 61-75 years; 5: ≥ 76 years	3.07
<i>College</i>	Dummy: Producer holds a college bachelor's degree or more = 1	0.293
<i>NoHighSch</i>	Dummy: Producer without a high school degree = 1	0.066
<i>Years</i>	Cts: Number of years a producer has been farming crawfish; 1: 1-7; 2: 8-14; 3: 15-21; 4: 22-28; 5: 29-35; 6: 36-42; 7: ≥ 43	3.26
<i>Grade</i>	Dummy: Producer grading crawfish prior to selling = 1	0.625
<i>Wash</i>	Dummy: Producer washing crawfish prior to selling = 1	0.318
<i>Months</i>	Cts: Number of months a producer harvests crawfish	5.6

Table 2: Farmers' Premarketing Practices.

Grade: Do you, at least sometimes, grade your crawfish prior to selling them?		
Categories	Frequency	Percentage
Yes	45	62.5
No	27	37.5
Total	72	100.0
Wash: Do you, at least sometimes, wash your crawfish prior to selling them?		
Yes	21	31.8
No	45	68.2
Total	66	100.0
Purge: Do you, at least sometimes, purge your crawfish prior to selling them?		
Yes	3	4.8
No	60	95.2
Total	63	100.0
Peel: Do you, at least sometimes, own or run a commercial crawfish peeling operation?		
Yes	5	7.7
No	60	92.3
Total	65	100.0

Table 3: Overview of Farmer Selection of Crawfish Marketing Outlets.

Which of the following marketing outlets do you use to sell crawfish? (Please check all that apply.)			
Categories	Total Responses	Frequency	Percentage
I sell to a processor	67	12	17.9
I sell to a wholesaler	67	43	64.2
I sell to a retailer	66	15	22.7
I sell directly to consumers	66	20	30.3

Note: A farmer may choose to market in more than one outlet during a production season, thus the sum of these percentages is >100%.

Table 4: Probit Results for Farmer's Choosing Marketing Outlets.

	Processors				Wholesalers				Retailers				Consumers			
	Coefficient (Robust Std. Error)		Marg. Effect		Coefficient (Robust Std. Error)		Marg. Effect		Coefficient (Robust Std. Error)		Marg. Effect		Coefficient (Robust Std. Error)		Marg. Effect	
<i>Acres</i>	-0.2498 (0.9455)		-0.0254		-0.3986 (0.9745)		-0.0789		1.1965 (0.6242)	*	0.3385	*	0.1028 (0.5158)		0.0319	
<i>%FarmCF</i>	0.1004 (0.2754)		0.0102		0.0860 (0.2154)		0.0170		-0.2642 (0.1918)		-0.0748		0.3067 (0.1752)	*	0.0951	*
<i>%HHFarm</i>	0.2312 (0.1674)		0.0235		0.6900 (0.1960)	***	0.1365	***	-0.3029 (0.2080)		-0.0857		-0.1461 (0.1514)		-0.0453	
<i>Age</i>	1.2420 (0.5234)	**	0.1264	**	-0.8132 (0.4563)	*	-0.1609	*	0.2508 (0.3844)		0.0710		0.2535 (0.3662)		0.0786	
<i>College</i>	-1.0519 (0.6145)	*	-0.0904		1.1558 (0.5863)	**	0.1925	*	0.0623 (0.5765)		0.0177		-0.1647 (0.5205)		-0.0502	
<i>NoHighSch</i>	1.8391 (1.0811)	*	0.5018		-2.4214 (0.8589)	***	-0.7727	***					1.8646 (0.9475)	**	0.6439	***
<i>Years</i>	-0.0801 (0.1428)		-0.0082		0.0887 (0.1622)		0.0176		0.0348 (0.1569)		0.0099		0.0377 (0.1338)		0.0117	
<i>Grade</i>	-0.9328 (0.6333)		-0.1132		1.4759 (0.5736)	***	0.3373	**	0.3782 (0.3998)		0.1042		-0.4690 (0.5073)		-0.1492	
<i>Wash</i>	0.2365 (0.8045)		0.0262		-2.3827 (0.8879)	***	-0.6626	***	0.6413 (0.7982)		0.1974		1.9029 (0.6462)	***	0.6336	***
<i>Months</i>	-0.0891 (0.2906)		-0.0091		0.2760 (0.2344)		0.0546		-0.1181 (0.2465)		-0.0334		-0.0946 (0.1833)		-0.0293	
<i>Constant</i>	-4.6791 (1.5415)				-1.0142 (1.5761)				-0.1886 (1.5640)				-1.6056 (1.2969)			
Obs.	48				48				45				47			
Pseudo R²	0.2417				0.4033				0.1620				0.2921			

Notes: *** indicates the variable is significant at the 0.01 level; ** indicates the variable is significant at the 0.05 level; * indicates the variable is significant at the 0.10 level.