Factors Affecting the Decision to Adopt and Continue Best Management Practices by Broiler Producers

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Abstract

We analyzed survey data collected from broiler producers in Louisiana to understand the factors affecting the longevity of best management practices adoption. Results indicated variables such as future expansion potential and the length of time the farm have been with the family decreases the chance of adopting best management practices. Our results support the idea that education and income would have positive results on the entry decision to adopt best management practices.

Key words: adoption, best management practices, broiler production, entry, exit

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Best management practices (BMPs) are voluntary practices recommended by the USDA under the Environmental Quality Incentive Program (EQIP) to overcome nonpoint source pollution. Government supports up to 90% of the total cost to implement these practices but still the adoption rate of the BMPs are not at the rate that the policy makers like to see. The main contention regarding the adoption has been its cost which is private in nature and benefit that is public in nature. Because farmers feel that they are funding public goods (water quality) without just compensation, the adoption and thereafter continuation of these practices have been of a serious concern. Most of the past studies on adoption uses probit/logit model to explain the probability of a firm adopting a new technology at a time. There is a lack of study explicitly addressing the time path of adoption which is an important aspect for adoption of environmental practices like BMPs which generally have contract obligation for as long as ten years.

Broiler production has been one of the major agricultural enterprises in the Southern USA. The ever expanding broiler production in the region also brings environmental concerns. The major problem associated with broiler production is disposal of broiler litter. While most of broiler operations are vertically integrated, the share of the cost for broiler litter disposal rests completely on broiler producers. In the lack of perfectly operating broiler litter market, farmers are forced to rely on land application of broiler litter on their own land. As a result, broiler producers have been applying broiler litter on the same patch of nearby pasture and cropland for number of years. This has exacerbated the problems of nutrient buildup in receiving soil and nutrient leaching and runoff to nearby water bodies. While farmers can be asked to adopt best management practices to minimize these potential damage, adoption rate has not been to the desired level of researchers. As a result there is a need to understand what factors make farmers adopt best management practices and retain it continuously for a long time and policy makers may benefit my knowing the important factors to increase the overall adoption rate. Understanding the factors impacting the adoption and continuation of best management practices may help to allocate scarce resources in a proper use.

The objective of this study is to identify the factors affecting the adoption and continuation of best management practices by broiler producers in Louisiana. We used survey data collected from broiler producers in the region to identify these factors.

Literature Review

Although there lacks previous studies directly related to BMP adoption and exit in broiler producers, there are other relevant articles in this area. We review these articles to gain insights on the entry and exit modeling effort and issues studied in economics.

Long and Jones (1980) evaluates women's entry-exit decision in the labor market and the factors affecting their labor supply decision. Using probit model the study finds the economic variables to be the important factors to contribute toward the labor supply decision. Result shows that women's level prior income increases their entry to the labor while spouse's prior income decreases their entry. The family characteristics such and number of children in the family has no impact on the entry-exit decision. The result implies that the economic factors are more important than other individual and family characteristics in entry and exit decision.

Abowd et al. (1999) address the issues related to the extent of entry and exits of worker, the role of skills in hiring and separation rate and the cyclical sensitivity of the employment flow. Analysis using dynamic optimization shows that nearly one third of the short term employment contract changes to long term contracts before they terminate. More than half of workers are separated due to the short term contracts and the common trends of entry and exit of work force is counter-cyclical.

Jocanovic and Lach (1989) studies S-shaped curve of the technology adoption. The study finds that the adoption is slow at the beginning, once individuals learn from the early entrants about the potential benefit from adopting the technology, the adoption rate increases faster up to some point then slower producing S-shaped adoption curve. The study shows that the firms facing competitive market are more likely to adopt slower than the monopoly. This is because, at the early stage the cost of adoption is higher and risk associated with it is unknown and the late entrant have lower production cost. The monopolists enter early realizing the greater advantage from higher revenues and the competitive firms enter late because of high cost at the early stage. This also suggests the economic factor is the leading cause in technology adoption.

Similarly, Mayer and Chappell (1992) report the profit and sunk cost make the firms more difficult to exit and advertising increases the number of entry. In case of exit higher capital intensity of a firm makes it harder to leave the business. However, the expected profit and capital intensity has no significant impact on entry. Stavins (1995) accesses the entry and exit of some specific computer model to the market. Their study suggests innovative ideas are less likely to leave the market. Firms running the business for long time and who have already established their reputation of quality product are more likely to enter their product in the market than the new entrants. These firms are also less likely to withdraw their product form the market.

Ward and Suiten (1994) follows profit maximization criteria while predicting the probability of a vessel entering, remaining in the Gulf of Mexico and exiting. The study finds that the indirect economic factor such as crowding is the major contributing factors to the entry and stay decision of a fisherman. The crowding externalities such as size of fleet have significant negative effect on entry decision irrespective of any change in abundance, or harvest cost.

Agrawal and Gort (1996) examine the stages of development in the market influences the entry exit and survival of firm in the market. The study reports that both the individual firm characteristics and market characteristics play a major role in entry and exit decision. The result indicates that the market attributes initially increases the hazard rate for early entrant in the new market. If the new firm enter the market with new product the firm is more likely to survive longer. Their result implies that if farmers adopt the BMP with higher technology, then they are likely to survive longer than others with lower technology.

The Moffit (2003) examines the role of non-financial variables in the entry and exit to the government welfare program. Using utility based model, the study shows that not only the financial variables contribute to the entry and exit to the welfare but there are other factors such as child support requirement, immunization requirement also contribute significantly to the worker's exit and entry to the welfare.

Method

To address BMPs adoption decision at first and then ultimate decision to terminate BMPs in a farm, we employed a proportional hazard model. A proportion hazard model helps to analyze the effect of economic and regulatory variables on adoption and exit decision by broiler producers with respect to adopting a new environmental friendly technology. The hazard model is appropriate because our focus is on the timing of new technology adoption and exit.

We followed Wooldgridge (2002) to develop our theoretical model. Indicate an initiate state as an adoption of a BMP by a broiler producer. T is the time measured in years until the broiler producer discontinues the BMP in his farm. The cumulative distribution function of T is defined as F(t) = P(T $\leq$t), here t denotes a particular value of T. The survival function, defined as the probability of a producer adopting the BMP past time t, is s(t) = 1-F(t) = P(T>t).

We assume a random draw i from broiler producers in Louisiana. Let a_i Є [0,b] denote the time at which broiler producer i adopts BMP, let t_i^* denote the length of time which s/he adopts a given BMP and let x_i denote the vector of observed explanatory variables. Assume that t_i^* has a continuous conditional density function $f(t \mid x_i;\theta); t \geq 0$ where θ is the vector of unknown parameters. To account for the right sensoring, we assume that the observed duration t_i is obtained as $t_i = \min(t_i^*, c_i)$. We assume that conditional on the covariates, the true duration is independent of the starting point a_i and the censoring time c_i. The conditional distribution D(.) can be written as $D(t_i^* \mid x_i, a_i, c_i) = D(t_i^* \mid x_i)$. Letting d_i be a censoring indicator (1/0 variable), the conditional likelihood for observation i can be written as:

$$f(t_i \mid x_i, \theta)^{d_i} [1 - F(t_i \mid x_i; \theta]^{1-d_i} .$$

If we have data on (t_i,d_i,x_i) for a random sample of size N, the maximum likelihood estimator of θ is obtained by maximizing:

$$\sum_{i=1}^{N} \{d_i \log[f(t_i \mid x_i;\theta)] + (1-d_i)\log[1 - F(t_i \mid x_i;\theta)]\}$$

The coefficients are then estimated using a maximum likelihood approach.

We estimated the parameterized baseline hazard approach for adoption and exit decisions. For robustness of the model, we conducted sensitivity analyses assuming that a hazard function possesses exponential, lognormal, log logistic, and Weibull density functions. These assumptions allow for the possibility that the baseline hazard increases or decreases over time.

Data

Data were collected in 2004 using Dillman's tailored designed method.A focus group, consisting of broiler producers and county agents from the twelve parishes in the principal broiler production area of Louisiana, was used to help design and pre-test the survey instrument. The survey was mailed to all 525 Louisiana poultry producers with an option to complete the survey online. Two weeks after the initial mailing, non-respondents were contacted with a postcard reminder request to complete the survey. A second round of surveys was mailed to poultry producers three weeks after the first round.

The twelve-page survey had three distinct sections including broiler litter disposal and best management practices adoption, willingness to pay and willingness to accept measures of compensations to reduce broiler production, and socio-economic characteristics of the principal operator. One section of the survey asked questions related to the adoption of best management practices (BMP) in terms of: 1) cost shares and EQIP incentive payments; 2) sources of information most important in making the adopt/non-adopt decision; and 3) the role of USDA-NRCS in the responder's adoption or non-adoption decision. Six BMPs identified by USDA-NRCS as most appropriate for Louisiana broiler farms were identified in terms of cost-share or EQIP incentive payment per practice. A common format used in presenting each of the six BMP practices and in eliciting responses is:

Compost facilities (NRCS code 317): *Compost facilities convert organic matter, such as dry poultry waste or dead chicken into a more uniform and relatively odorless substance called humus. Estimated cost for 6- bin composting facility $18,090.*

Have you adopted this BMP?

□ YES. → If YES, Which year was it adopted? __________If once adopted but stopped now, then which year was it stopped?_______________Your initial cost share%__

□ NO → If NO, would you adopt it? □ YES → If YES, what % of cost share would you pay?____

□ NO

□ Not ideal for my farm

The BMP was described in the survey and identified with its USDA-NRCS code number and an estimated reference cost. The BMP reference cost was an average cost based on adoption information of the BMP in Louisiana between 1997 and 2001.

Results and Conclusions

We estimate the hazard model for the entry decision to BMP adoption. The interpretation of coefficients obtained from a hazard model is not straightforward since the model accommodates the non-linear function of explanatory variables. However, the hazard rate of each individual explanatory variable provides information about the relative importance of the variables to the hazard rate. Therefore, hazard rates of an individual moving from stage of no-adoption to adoption is estimated using a proportional hazard model. The estimated coefficients and hazard ratios are presented in table 1. The rates are calculated by setting continuous variables at their mean and indicator variables at zero.

The result shows that the higher expected cost in future lowers the likelihood of adopting the BMPs. On the other hand, the environmental concern variable is not significant indicating that farmers adopt BMPs without any concern over the negative environmental effect of the poultry firm. Such result implies that the farmers are more economy oriented than environmental benefit. The hazard ratio also suggests the decreasing rate of entry if the expected future spending is high.

The longer the family stays in the broiler firm business, the less likely they are to adopt the BMPs. The decreasing rate of hazard indicates the longer the family stays in the business, the more resist they are to adopt the environmental friendly BMPs. If spouse has off farm income then the individual is less likely to adopt the practices. However, if the operator has off farm income he/she is more likely to adopt the practices. The income from poultry is significant and increases the probability to adopt with the increase in income from poultry. This support the idea of Jovanovic and Lach (1989) who suggest the economic factors contribute significantly to the technology adoption.

Result shows that the firms near by the residential subdivisions are more likely to adopt the best management practices to reduce the pollution for the residents. In addition, risk-averse individuals are less likely to adopt the practices. Spouse's off farm income, and number of birds have no effect on adopting the technology that reduces the pollution level form poultry production.

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Table 1. Parameter Estimates for the Entry Decision

Variables	Coeff. (Robust S.E.) OLS	Coeff. (S.E.) Exponential	Coeff. (S.E.) Weibull	Coeff. (S.E) Logistic	Coeff. (S.E.) Lognormal	Hazard Ratio
Number of birds	0.000 (0.000)	-0.00001 (0.000)	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	1.000
Future spending	2.275* (1.252)	-0.147 (0.126)	0.167 (0.114)	0.282** (0.124)	0.239* (0.136)	0.863
Relative risk	0.396 (0.293)	-0.072* (0.044)	-0.011 (0.031)	0.008 (0.030)	0.138 (0.035)	0.931
Family in the firm (yr) 5c	0.551*** (0.129)	-0.059*** (0.015)	0.025** (0.011)	0.0195* (0.011)	0.022* (0.011)	0.942
Education 5d	-3.274*** (1.069)	0.240* (0.149)	- 0.214** (0.099)	-0.107 (0.117)	-0.127** (0.135)	1.272
Operator's off farm income 1=yes 5i	-9.186*** (2.528)	0.867*** (0.304)	- 0.849** * (0.232)	-0.947 (0.291)	-0.775 (0.308)	2.380
Spouse's off farm income 1=yes 5j	4.157* (2.439)	-0.513 (0.337)	-0.172 (0.296)	0.053 (0.344)	0.141 (0.354)	0.598
Marital status 5f	3.351 (2.076)	-0.379* (0.233)	0.632** (0.275)	0.575** (0.245)	0.474** (0.237)	0.684
Subdivision nearby yes=1 5p	0.488 (2.387)	0.266 (0.322)	-0.88 (0.058)	-0.080 (0.062)	-0.045 (0.068)	.305
Environmental concerns 5r	-0.557 (0.397)	-0.022 (0.0489)	0.282 (0.252)	0.327 (0.259)	0.396 (0.324)	0.976
Income from poultry 5l	-1.891** (0.959)	0.349** (0.160)	- 0.356** * (0.120)	- 0.455** * (0.154)	- 0.482*** (0.165)	1.4191
	-3.87968 (3.279)					
Scale parameter			0.555 (0.072)	0.411 (0.055)	0.758 (0.083)	1.305

Shape parameter	1.802 (0.233)	1.305