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**HEDONIC ANALYSIS OF WATERFOWL  
HUNTING LEASE ATTRIBUTES:**

**AN EVALUATION OF  
OWNER-PROVIDED SERVICES**

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## *Abstract*

The role of owner-provided services in fee-based recreation access is evaluated for the case of waterfowl hunting. An hedonic framework is used to analyze and estimate the implicit price of some waterfowl hunting lease attributes. A mail survey of Louisiana waterfowl hunters provides primary data for estimation of the hedonic price model specified in semi-log functional form. The willingness-to-pay functions for increased acreage per hunting club member, increased lease time, and travel distance are also empirically estimated, providing information on the implicit demand for these lease characteristics.

### **KEY WORDS:**

Hedonic, Waterfowl Hunting, Outdoor Recreation

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## **1.Introduction**

Demographic and social profiles of recreationists suggest a tendency toward specialization associated with increased income, age, and experience (Heywood, 1987; Schreyer, et al., 1984). These factors together reflect an investment in human capital (development of recreation related skills) as well as an investment in other forms of recreation capital, including specialized equipment or improved access to the recreation site through land purchases or leasing. Many specialized outdoor recreationists, including waterfowl hunters, rely on fee-based access to recreation sites which may be specialized and relatively fixed in supply.

In many states, landowners interested in participating in this market for fee-based recreation access to waterfowl hunting lack information regarding the owner-provided services demanded by waterfowl hunters (Allen, et al., 1985). For example, access may be through a commercial day hunt operation with minimal provision of services, a commercial lodge offering short term, hotel-like accommodation, or provision of seasonally leased acreage with optional owner provided services. In the case of landowners seeking to maximize rents by providing land for waterfowl hunting leases, owner-provided services can include land preparation and flooding, construction of blinds or pits, improved access (boat launch or road improvement), or provision of liability insurance. However, without information describing the demand for these lease attributes, landowners may over provide or under provide services, provide improperly tailored services, or provide the wrong services as part of the lease price.

This research draws on economic characteristic theory and the hedonic price method to empirically evaluate the attributes of fee-based recreation access to migratory waterfowl (Lancaster, 1966; Freeman, 1979). Primary data is used in an hedonic price framework to empirically identify the characteristics of waterfowl hunting leases in Louisiana which significantly contribute to the value of a lease. The term "lease", as used in this study, refers to the land to which hunting access rights are obtained, not the legal agreement granting access rights. The next section of the paper presents an overview of the hedonic price method with selected applications, followed by data collection procedures and data description. Estimation of the hedonic price function and the implicit prices of selected lease attributes follow. The paper concludes with a summary and discussion of the empirical

results, emphasizing managerial applications for landowners interested in waterfowl leases.

## **2. Hedonic Price Theory: Applications**

Characteristic theory and the hedonic price method of analysis assume that a commodity such as leased hunting land can be viewed as an aggregation of individual components or attributes (Griliches, 1971). Consumers are assumed to behave in such a way that they purchase goods embodying bundles of attributes that maximize their underlying utility functions. Rosen (1984) describes the process in which prices reveal quality variations as relying on producers who "tailor their goods to embody final characteristics described by customers and receive returns for serving economic functions as mediaries". The hedonic price method originates from Lancaster's (1966) proposal that goods are inputs in the activity of consumption, with an end product of a set of characteristics. Bundles of characteristics rather than bundles of goods are ranked according to their utility bearing abilities. Attributes are implicitly embodied in goods and their observed market prices. The amount or presence of attributes associated with the commodities defines a set of implicit or "hedonic" prices (Rosen, 1984). The marginal implicit values of the attributes are obtained by differentiating the hedonic price function with respect to each attribute (Freeman, 1979; McMillan et al., 1980).

The hedonic price method has been applied to wildlife related recreation resources (Pope and Stoll, 1985; Livengood, 1983; Pope et al., 1984; and Messonnier and Luzar, 1990), agricultural commodities (Brorsen et al., 1894; Ethridge and Davis, 1982; Wilson, 1984), and residential amenities (Blomquist and Worley, 1981; McMillan et al., 1980; Witte et al., 1979; and Milon et al., 1984). Other applications have involved the estimation of the benefits of environmental improvements (Freeman, 1979; Blomquist and Worley, 1981; Harrison and Rubinfeld, 1978; and McMillan et al., 1980), which include the complete, two-stage hedonic analysis. The first stage involves estimating the implicit price function for a good's attributes. The inverse demand function for a characteristic of interest is estimated in a second stage by regressing individual household marginal willingness-to-pay on the level of the characteristic and other household characteristics hypothesized to affect demand.

This analysis used the hedonic price method to empirically evaluate the contribution of owner-provided services to the value of a waterfowl hunting lease in Louisiana. Owner-provided services as well as other characteristics of waterfowl leases were hypothesized to

influence the price paid for the lease. Within the hedonic framework, this analysis involved regressing observed market prices paid for waterfowl hunting leases against those characteristics of a lease hypothesized to be determinants of the price paid. Attributes chosen for this analysis characterize waterfowl leases in terms of habitat, distance, length of lease, and by services provided by the landowner. Attributes hypothesized to contribute to the value of a waterfowl hunting lease included lease acreage per member, number of years leased, distance from the hunter's home to the lease, binary variables representing the habitat type, (coastal marsh, bottomland hardwood, or cropland) and binary variables indicating landowner provision of services such as land preparation and flooding, construction of blinds or pits, access improvement (roads, boat launch), or liability insurance.

Implicitly, the model for the hedonic price function was specified as:

$$[1] \quad \text{PRICE} = f(\text{IMPROVE, BLINDS, LANDPREP, HABITAT, NONCON, ACPERMEM, DISTANCE, LEASEYR, } \varepsilon)$$

Variables in the model were defined as:

PRICE	=	Price paid per club member for access rights
ACPERMEM (+)	=	Acres of lease per club member
DISTANCE (+)	=	Distance of lease from respondent's home (in miles)
IMPROVE (+)=		Dummy for landowner provided access improvements; 1 if provided, 0 otherwise
BLINDS (+)	=	Dummy for landowner provided hunting blinds or pits; 1 if provided, 0 otherwise
LANDPREP (+)	=	Dummy for landowner provided land preparation or flooding; 1 if provided, 0 otherwise
NONCON (+) =		Dummy for availability of nonconsumptive lease uses (eg. wildlife viewing); 1 if available, 0 otherwise
LEASEYR (+)=		Years the land has been leased for waterfowl hunting
HABITAT (+)=		Dummy for waterfowl lease habitat; 1 if coastal marsh, 0 otherwise
$\varepsilon$	=	Error term

*A priori* hypotheses are indicated by (+) and (-) in the above specification. Greater acreage per hunter on a lease was hypothesized to allow club members to reduce the congestion they might face on smaller leases or leases with high membership relative to the leased land area. Availability of alternative, nonconsumptive uses of the hunting lease spreads the use of the lease beyond the very limited waterfowl hunting season. It was therefore hypothesized that as acreage per hunter increased and the availability of other nonconsumptive uses was exhibited, lease price per member would increase. Due to travel costs, it is traditionally hypothesized that as distance from the hunter's home to the lease increased, lease price should decrease. However, in the very specialized case of waterfowl hunting, it was hypothesized that hunters would pay a premium for remote waterfowl bearing habitat, suggesting a positive relationship between price per member and distance. Although migratory waterfowl can be found in a variety of habitats, including bottomland hardwood forests, coastal marshes, inland wetlands, and agricultural cropland, some habitats offer superior access. Habitat type, in this specification, coastal marsh, was hypothesized to positively influence price paid per member for waterfowl leases. Landowner provision of amenities and services was hypothesized to increase the value of a lease. Therefore, coefficients of variables representing landowner provided land preparations, construction of blinds or pits, or access improvements (boat launch or roads) were expected to exhibit positive signs. Although landowner provided services were hypothesized to positively contribute to the value of a waterfowl lease, an alternative hypothesis suggests that specialized waterfowl hunters would prefer to lease acreage without landowner provided improvements and through time, add their own preferred lease attributes. The number of years that land had been leased for waterfowl hunting was therefore hypothesized to be positively associated with the value of a waterfowl lease. In this case, owner provided services might be viewed as inconsequential or intrusive by long term lease members.

### **3. Data Collection Procedures**

Data for empirical estimation of the economic model were collected through a mail survey of 7,022 of the 65,000 individuals who purchased duck stamps sold by the Louisiana Department of Wildlife and Fisheries for the 1990-1991 waterfowl hunting season. The final response rate for the survey which was conducted using the Dillman Total Design Method (Dillman, 1978) was 47 percent, or 3,319 usable responses. Data for this analysis come from a subsample of this data comprised of the 840 waterfowl hunters who indicated they leased

land in Louisiana for waterfowl hunting during the 1990-1991 waterfowl hunting season.

The mail survey elicited information from stamp duck purchasers regarding physical and biological characteristics of the leased land, services and facilities associated with the lease, hunting activities, and socio-economic attributes of the respondents. Data requirements of the hypothesized economic model resulted in a reduction of observations to a usable sample size of 418 waterfowl hunters. Data for this subsample indicate that a typical waterfowl lease had 21.9 members who leased an average of 1,409 acres. Hunters who leased paid an average of \$4,195 for the entire lease, and on average, had leased the land for over 12 years. The average one way travel distance to the lease was 53.2 miles.

#### **4. Empirical Estimations**

The economic model specified in [1] was estimated using SAS and data from the waterfowl hunting survey. Economic theory offers little guidance with respect to the choice of functional form for the hedonic equation (Freeman, 1979). While earlier hedonic studies used linear specifications, recent investigations aimed at identifying more appropriate functional specifications have indicated the superiority of flexible forms (Cooper et al., 1987; Milon et al., 1984). Coefficients resulting from linear specifications identify the relative contribution of their respective attributes to the price of the product. Linear specifications, however, imply constant marginal willingness-to-pay for all households consuming the good (Freeman, 1979). This does not allow for the identification of the demand schedule for the attribute in question and also ignores the possibility that demand for the attribute may be a function of its level as well as the level of other attributes. In the case of non-linear specifications, the first derivative of the hedonic price function with respect to the specified attribute yields the implicit marginal price of the attribute (McMillan et al., 1980).

As economic theory provides no clear guidance regarding the choice of functional form to be used in hedonic regressions, it can be argued that the transformation which best fits the data is preferred. An empirical search for alternative functional forms indicated that the semi-log functional form yielded the best fit for this specification. Results of the empirical estimation of the hedonic price function with only the dependent variable, PRICE, logged are presented in Table 1. The R-square value presented is comparable to those of similar cross-sectional studies (Messonnier and Luzar, 1990; Livengood, 1983; Pope and Stoll, 1985).

**Table 1**  
**Price Equation Estimates: Hedonic Price Model of Louisiana Waterfowl**  
**Hunting Leases, 1990-91 Waterfowl Hunting Data<sup>a</sup>**

Variable	Coefficient	Variable Mean
PRICE (per member)	-	451.296
ACPERMEM	0.00051 (2.302)	138.320
DISTANCE	0.00501 (2.159)	53.253
IMPROVE	-0.3415 (-0.727)	0.050
LANDPREP	0.39707 (0.695)	0.046
MARSH	2.27021 (1.930)	0.004
NONCON	0.79315 (2.289)	0.064
LEASEYR	0.01843 (1.480)	12.947
INTERCEPT	4.64781 (16.846)	-
n	418	
R <sup>2</sup>	0.38	

<sup>a</sup>t-values in parentheses. Critical t-statistics at the 1%, 5%, and 10% levels are 2.326, 1.645, and 1.282, respectively.

At the five percent level of confidence, acres per member, distance, nonconsumptive uses of the lease, and habitat were found to be significant contributors to the value of a Louisiana waterfowl hunting lease. The number of years leased was significant at the ten percent confidence level.

Owner provided services, including provision of blinds, land preparation, and access improvements were not found to significantly contribute to the value of a Louisiana waterfowl hunting lease, and in the case of access improvements had an inverse relationship with lease price. These results tend to support the hypothesis that waterfowl hunters prefer leases offering adequate acreage per member (lower congestion) in a particular habitat that they can lease over a period of years. In this environment, waterfowl hunters may be substituting their own inputs into the production of hunting access rather than pay in the market for owner provided services.

The identified hedonic price function was next differentiated with respect to *ACPERMEM*, *DISTANCE*, and *LEASEYR* for each household. These derivatives, when evaluated at each household's level of the attributes, provide an estimation of the household's marginal implicit willingness-to-pay for these attributes. Differentiation of the function estimated by the hedonic regression with respect to the selected attributes results in the vectors of individual, marginal implicit prices given by:

$$\begin{aligned}
 [2] \quad & P_{APM}_i = 0.00051e^{4.6478 + 0.7931NONCON_i + 0.00051ACPERMEM_i} \\
 [3] \quad & P_{DIST}_i = 0.0050e^{4.6478 + 0.7931NONCON_i + 0.0050DISTANCE_i} \\
 [4] \quad & P_{YEARS}_i = 0.0184e^{4.6478 + 0.7931NONCON_i + 0.0184LEASEYR_i}
 \end{aligned}$$

The resulting vectors of prices were in turn regressed on significant attributes, *ACPERMEM*, *DISTANCE*, and *LEASEYR* and three dummy variables indicating three income levels. It was assumed in this analysis that due to the short-run, cross-sectional nature of the data, the supply of leasable hunting land was fixed thereby eliminating identification problems. The implicit specification for estimation of these inverse demand functions is given as:

- [5] PAPM = f(ACPERMEM, HIGHINC, MEDINC, LOWINC,  $\varepsilon$ )
- [6] PDIST = f(DISTANCE, HIGHINC, MEDINC, LOWINC,  $\varepsilon$ )
- [7] PYEARS = f(LEASEYR, HIGHINC, MEDINC, LOWINC,  $\varepsilon$ )

Variables, with *a priori* hypothesized signs in parentheses, were defined as:

- PAPM = Marginal implicit price of ACPERMEM  
 ACPERMEM (+) = Acres of lease per club member  
 PDIST = Marginal implicit price of DISTANCE  
 DISTANCE (+) = Distance of lease from respondent's home (in miles)  
 PYEARS = Marginal implicit price of LEASEYR  
 LEASEYR (+) = Years the land has been leased for waterfowl hunting  
 HIGHINC (+) = Dummy for high income level; 1 if at least \$45,000 per year, 0 otherwise  
 MEDINC (+) = Dummy for medium income level; 1 if \$25,000 to \$44,999 per year, 0 otherwise  
 LOWINC (-) = Dummy for low income level; 1 if \$24,999 or less per year, 0 otherwise

The binary variables representing the three income levels were included as hypothesized demand shifters. Using MEDINC as the base income level, higher income levels would be expected to shift demand outward, while lower income levels were expected to shift demand inward. Results of these estimations are presented in Table 2. The attributes ACPERMEM, LEASEYR, and DISTANCE are significant at the five percent confidence level, as well as dummy variables representing low income and medium income (intercept terms). Taking the anti-log of these functions yields the following relationships:

- [8]  $PAPM = e^{0.06156} ACPERMEM^{0.00008}$
- [9]  $PDIST = e^{0.66050} DISTANCE^{0.00426}$
- [10]  $PYEARS = e^{1.86184} LEASEYR^{0.10249}$

**Table 2**  
**Demand Equation Estimates: Hedonic Price Model of Louisiana Waterfowl**  
**Hunting Leases: 1990-91 Waterfowl Hunting Data<sup>a</sup>**

Variable	Coefficient <sup>b</sup>	Variable Mean <sup>b</sup>	Coefficient <sup>c</sup>	Variable Mean <sup>c</sup>	Coefficient <sup>d</sup>	Variable Mean <sup>d</sup>
ACPERMEN	0.000081 (10.109)	138.32				
LEASEYR			0.102491 (4.170)	12.94		
LDIST					0.004270 (5.256)	53.25
HIGHINC	0.001227 (0.114)	0.454	0.196576 (0.424)	0.454	0.024041 (0.187)	0.454
LOWINC	0.282203 (7.004)	0.156	2.213576 (1.603)	0.156	0.626810 (1.657)	0.156
INTERCEPT	0.061570 (6.388)	0.310	1.861847 (4.170)	0.310	0.660501 (5.459)	0.310
n	418		418		418	
R <sup>2</sup>	0.889		0.505		0.387	

<sup>a</sup>T-values in parentheses

<sup>b</sup>Hedonic price function differentiated with respect to ACPERMEN

<sup>c</sup>Hedonic price function differentiated with respect to LEASEYR

<sup>d</sup>Hedonic price function differentiated with respect to DISTANCE

The empirical relationships defined by these implicit prices and income levels suggest that these attributes of waterfowl hunting leases are less responsive to income changes than some other forms of hunting recreation, including deer hunting and small game hunting (Livengood, 1983; Messonnier and Luzar, 1990). Waterfowl hunting has evolved as a specialized outdoor recreation activity characterized by participants with relatively high income levels (Wesley, 1987). Increased specialization in outdoor recreation and the relatively high income levels of waterfowl hunters may influence the demand for lease attributes, including owner provided services.

## **5. Summary and Conclusions**

The recreation trend of increased specialization coupled with conditions of restrictive access due to resource availability (including regulatory restrictions and habitat availability) have reduced the number of waterfowl hunters nationally. Waterfowl hunters who have remained with the sport often resort to fee based access to habitat at a relatively high cost per member. Landowners recognizing the alternative income opportunities associated with leasing land for fee based waterfowl hunting access typically have little information upon which to base decisions regarding the bundle of goods to provide hunters.

This hedonic analysis of owner-provided services for waterfowl leasing suggests that waterfowl hunters will pay to reduce congestion (increase acres per member) and for prime habitat (coastal marsh) and are willing to pay the increased travel costs associated with these lease attributes. This analysis also suggests that Louisiana waterfowl hunters are not willing to pay for owner-provided improvements such as duck blinds or boat launches but would rather substitute their own inputs over an extended lease period. Landowners as a result may avoid costly improvements to their land and instead offer longer term leases.

## References

- Allen, T.J., D.K. Smith, and A. Ferrise. *Real Property: Leasing Land for Hunting Activities and Other Outdoor Recreation Activities*. C.E.S W.V.U., Morgantown, West Virginia. 1985.
- Blomquist, G. and L. Worley. "Hedonic Prices, Demand for Urban Housing Amenities and Benefit Estimates." *Journal of Urban Economics*, 9(1981): 212-221.
- Brorsen, B. W., W. R. Grant, and M. E. Rister. "A Hedonic Price Model for Rough Rice Bid/Acceptance Markets." *American Journal of Agricultural Economics*. 66:2(1984): 156-163.
- Cooper, M. L., L. B. Deck, and K. E. McConnell. "On the Choice of Functional Form for Hedonic Price Functions." Resources for the Future Discussion Paper QE87-08. Washington, DC: Resources for the Future, 1987.
- Dillman, D. A. *Mail and Telephone Surveys*. New York: John Wiley & Sons, 1978.
- Ethridge, D. E. and B. Davis. "Hedonic Price Estimation for Commodities: An Application to Cotton." *Western Journal of Agricultural Economics*. 7:2(1982): 293-300.
- Freeman, M. A. *The Benefits of Environmental Improvements*. Washington, D.C.: Resources for the Future, 1979.
- Griliches, Z., ed. *Price Indexes and Quality Changes: Studies in New Methods of Measurement*. Cambridge, Mass: Harvard U. Press, 1971.
- Harrison, D. and D. L. Rubinfeld. "Hedonic Housing Prices and the Demand for Clean Air." *Journal of Environmental Economics and Management*. 5(1978): 81-102.
- Heywood, John L. "Experience Preferences of Participants in Different Types of River Recreation Groups." *Journal of Leisure Research*. 19:1(1987): 1-12.
- Lancaster, K. J. "A New Approach to Consumer Theory." *Journal of Political Economy*. 74:2(1966): 132-157.
- Livengood, K. R. "Value of Big Game from Markets for Hunting Leases: The Hedonic -- Approach." *Land Economics*. 59:3(1983): 287-291.
- McMillan, M. L., B. G. Reid, and D. W. Gillen. "An Extension of the Hedonic Approach for Estimating the Value of Quiet." *Land Economics*. 56:3(1980): 315-328.
- Messonnier, Mark L. and E. Jane Luzar. "A Hedonic Analysis of Private Hunting Land Attributes Using an Alternative Functional Form." *Southern Journal of Agricultural Economics*. 23(1990): 112-117.
- Milon, J. Wally, Jonathan Gressel, and David Mulkey. "Hedonic Amenity Valuation and Functional Form Specification." *Land Economics*. 60:4(1984): 378-387.

- Pope, C. A. and J. R. Stoll. "The Market Value of Ingress Rights for White-Tailed Deer Hunting in Texas." *Southern Journal of Agricultural Economics*. 17:1(1985): 177-182.
- Pope, C. A., C. E. Adams, and J. K. Thomas. "The Recreational and Aesthetic Value of Wildlife in Texas." *Journal of Leisure Research*. 16:1(1984): 51-60.
- Rosen, S. "Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition." *Journal of Political Economy*. 82:1(1984): 34-55.
- Rubinfeld, D.L. "Voting Behavior in a Local School Election: A Micro Analysis." *The Review of Economics and Statistics*. 59:1(1977): 30-42.
- Schreyer, Richard, David W. Lime, and Daniel R. Williams. "Characterizing the Influence of Past Experience on Recreational Behavior." *Journal of Leisure Research*. 16:1(1984): 34-50.
- Sheriff, S.L., et al. "Missouri's Landowners: How They Perceive the Importance of Wildlife." in *Transactions of the North American Wildlife and Natural Resources Conference*. 46:(1981): 118-124.
- Wesley, David E. "Socioduckonomics." *Valuing Wildlife: Economic and Social Perspectives*. Daniel J. Decker and Gary R. Goff (eds.), Boulder, Colorado: Westview Press, 1987: 136-142.
- Wilson, W. W. "Hedonic Prices in the Malting Barley Market." *Western Journal of Agricultural Economics*. 9:1(1984): 29-40.
- Witte, A. D., H. J. Sumka, and H. Erekson. "An Estimate of a Structural Hedonic Price Model of the Housing Market: An Application of Rosen's Theory of Implicit Markets." *Econometrica*. 47:5(1979): 1151-1173.