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A Hedonic Analysis of Big Game Hunting Club Dues in Georgia, USA

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ABSTRACT

Hunting lease revenue can be a reliable supplemental income for forest landowners. Although studies have examined factors influencing per acre lease rates, little is known about how various characteristics are capitalized in hunting club dues. The objective of this study was to conduct a hedonic analysis of big game hunting club dues in Georgia, USA using a variety of club-, site-, and location-specific characteristics. To accomplish this objective, multivariate regression analysis was applied to explain variation in hunters' self-reported big game hunting club dues in 2012. Implicit price was then calculated for each significant covariate. Club size, presence of food plots, and game quality had positive effects on club dues, whereas membership number had a negative effect. These results should be useful for landowners and club lease managers interested in enhancing the marketability of their hunting sites and understanding the effect of management actions.

KEYWORDS

Big game hunting; hedonic; hunting clubs; hunting lease revenue; hunting leases

Introduction

In the United States, lease hunting has become a popular alternative for many hunters who either lack free private access options or prefer not to hunt on public land. Typically, hunters obtain access rights to a site by purchasing a lease outright or becoming a member of a hunting club. With leasing, hunters often enjoy a higher quality hunting experience (e.g., less crowding, predictable situations, longer seasons) than with public lands, whereas forest landowners benefit from additional income, access control, and reduced property damage due to trespassing (Hussain et al., 2007; Marsinko, Smathers, Guynn, & Stuckey, 1992). For many landowners (corporate or noncorporate), hunting lease revenues can be important considering property taxes (Arano, Cushing, & Munn, 2002) and the number of years it may take for timber sale revenues to materialize (Yarrow & Yarrow, 1999). Lease hunting can be beneficial from both economic (e.g., jobs, income) and ecological (e.g., habitat management, population control) standpoints (Benson, 2001; English & Bergstrom, 1994).

With leasing, landowners sell hunting rights to an individual, a group of people, or a hunting club (Mozumder, Starbuck, Berrens, & Alexander, 2007). Common lease

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arrangements include a single year with the ability to renew annually, multiple year, and limited term or seasonal durations (Porter, Masters, Bidwell, & Hitch, 2007). Hunting clubs are believed to prefer long-term leases that provide the opportunity to make wildlife habitat improvements and increase hunter convenience and safety (Pierce, Moore, & Matthews, 2008). In contrast to independent lease holders, hunting club members are typically subject to club rules and bylaws that guide the behavior of club members. Whether formal or informal, club rules specify what is expected of each club member and what is not allowed. Specific areas addressed by club rules include guest privileges and regulations, hunter safety, land management, rules of the hunt, and maintenance of facilities or structures such as stands (Miller, 2015). Club bylaws establish how a club is organized and managed. Specific club bylaws can include how membership is established, how disputes are addressed, and how club officers are determined (Plum Creek, 2015). To make management decisions, clubs can put all decisions to a vote, elect officers, or allow all decisions to be made by a single person. In the case of noncorporate landowners, club rules and bylaws may be determined solely by the landowner. Hunting clubs offer members advantages not necessarily available to independent lease holders. Although examples include companionship with other members and an increased sense of safety and security (Stribling, 1996), the biggest advantage is the relative cost.

The hunting club membership market in the United States is generally not centralized or formal. Membership in some clubs is more formal, and therefore the clubs shop for hunting sites. In less formal clubs, one or more hunters recruit new club members for the duration of the lease (most often one year). Lease suppliers, hunting clubs, and individual hunters also connect with each other by relying on word of mouth, family, friends, local papers, or work contacts (Hussain et al., 2007). Alternatively, large corporate landowners, such as Weyerhaeuser, maintain websites listing available leases and clubs seeking members (Weyerhaeuser, 2016). In addition, publications aimed at consumptive outdoor sporting enthusiasts often have sections with hunting club information. For example, Georgia Outdoor News (GON) maintains an annual issue and a message board dedicated to available hunting clubs and leases.

Hunting club dues vary based on factors such as quality and quantity of game species, services offered, management practices adopted, location, and site size (Pope & Stoll, 1985). Given this variability, methods for determining club dues are mixed and often informal. The hedonic pricing approach to economic valuation provides a formal method for understanding factors affecting hunting club membership dues. The hedonic method is one of a number of nonmarket approaches used for estimating economic values associated with environmental or recreation amenities. The underlying assumption of the hedonic method is the price of a good is a function of its attributes (Rosen, 1974). Given that heterogeneous goods possess varying qualities and characteristics, price variation involving these goods can be observed (Taylor, 2003). This method relies on this variation in price to estimate the value of a good's attributes. As a result, economic values for nonmarket goods, such as environmental amenities, are not directly observed, but are inferred from observable market transactions (Taylor, 2003). By observing market transactions for a heterogeneous good (e.g., hunting lease), implicit prices for attributes (e.g., lease size, land cover type, animal density, harvest restrictions) related to the good can be estimated. Implicit price is a measure of marginal willingness to pay (WTP) for a good's attribute. This approach assumes, for example, that individual club dues are a

product of attributes related to the club. Hedonic modeling also provides the opportunity for estimating marginal economic values associated with each club attribute and quantifying how each attribute, on average, influences individual club dues.

Factors influencing lease price

Primary and secondary hunting lease markets exist in the United States. For example, private corporate and noncorporate landowners provide lease opportunities to individuals or hunting clubs. Typically, landowners providing lease opportunities sell access to an entire tract on a per acre basis. In the hedonic literature, researchers have often examined factors affecting per acre lease rates (Hussain et al., 2007; Munn & Hussain, 2010; Rhyne, Munn, & Hussain, 2009; Shrestha & Alavalapati, 2004; Standiford & Howitt, 1993; Zhang, Hussain, & Armstrong, 2006). However, a secondary lease market is present when hunting clubs sell membership opportunities to hunters who are not necessarily interested in becoming independent leaseholders. Although some hunting clubs prefer a long-term lease duration (Pierce et al., 2008), membership in a club can be more dynamic because hunters often have the opportunity to choose which club to join or leave each season. Hunting club membership dues are typically paid before the beginning of the fall hunting season and are not expressed in dollars per acre. Club dues are usually set (and often negotiated) for the entire lease property. Only a few studies focused on this aspect of lease markets and examined factors affecting individual hunting club membership dues (Livengood, 1983; Messonier & Luzar, 1990; Pope & Stoll, 1985).

The hedonic literature on per acre hunting lease rates is relatively vast and up-to-date. Lease rates have been examined mostly by surveying landowners or ranchers (Hussain et al., 2007; Shrestha & Alavalapati, 2004; Standiford & Howitt, 1993; Zhang et al., 2006). More recent studies utilized data from publicly auctioned hunting leases (Munn & Hussain, 2010; Rhyne et al., 2009). Lease rates were found to be negatively correlated with lease size (Munn & Hussain, 2010; Rhyne et al., 2009; Shrestha & Alavalapati, 2004; Standiford & Howitt, 1993; Zhang et al., 2006). Shrestha and Alavalapati (2004) examined the effect of crowding and found no significant relationship between number of hunters and per acre lease rates. Proportion of hardwood forest coverage was found to positively affect per acre lease rates, whereas the proportion of pine and mixed forest coverage was found to have the opposite effect (Hussain et al., 2007; Munn & Hussain, 2010; Rhyne et al., 2009). Zhang et al. (2006) found that habitat improvements made by landowners (e.g., food plots, wildlife feeders) had a positive effect on per acre lease rates in Alabama. Similarly, Zhang et al. (2006) found that services provided to hunters such as stands, food, lodging, and guidance also had a positive effect on lease rates. Rhyne et al. (2009) and Munn and Hussain (2010) found that leases located in counties with higher projected Boone and Crockett (B&C) scores possessed higher lease rates in Mississippi. Meanwhile, Standiford and Howitt (1993) found no significant premium associated with game quality for deer in California. Higher per acre lease rates were found in rural areas compared to urban areas in Mississippi (Rhyne et al., 2009) and Florida (Shrestha & Alavalapati, 2004). Although factors related to available game species and hunting seasons were not considered in the respective hedonic models,

Hussain et al. (2007) and Rhyne et al. (2009) found that geographic segments within their study area (Mississippi) exhibited varying and significant effects on per acre lease rates.

Alternatively, the hedonic literature on hunting club dues is less developed and less current. Data for these studies were acquired by surveying hunting clubs in Louisiana (Messonier & Luzar, 1990) and licensed hunters themselves in Kansas (Livengood, 1983) and Texas (Pope & Stoll, 1985). Similar to studies examining lease rates, factors considered in analysis of determinants of club dues include lease size, services provided, and proximity to urban areas. Individual club dues for deer hunting specifically were found to be positively influenced by lease size (Livengood, 1983; Pope & Stoll, 1985) and acres per member (Messonier & Luzar, 1990). In addition, Livengood (1983) found the effect of increasing membership on hunting club dues was negative. Pope and Stoll (1985) found that amenities provided to hunters such as blinds, guidance, electricity, and feed did not significantly affect club dues for deer hunting in Texas. Similarly, Messonier and Luzar (1990) found the presence of a cabin on site did not significantly affect club dues in Louisiana. Finally, in Texas, higher club dues were found near urban areas (Pope & Stoll, 1985).

Thus, only a few studies have examined factors influencing club dues and most are nearly three decades old. In addition, only one of these studies (Messonier & Luzar, 1990) was conducted in a southeastern state. By examining club membership market transactions, a greater understanding of this aspect of the hunting lease market can be achieved. Similar to previous studies, factors related to lease size, membership number, site quality, and location were hypothesized to influence hunting club dues in Georgia. As a result, this study uses a hedonic modeling approach to identify factors affecting individual big game hunting club membership dues in Georgia and estimate the implicit price associated with these factors. Results should be useful for hunting club managers and landowners interested in understanding whether and how site characteristics, club attributes, and forest management affect club dues.

Methods

Study area

This study was conducted in the state of Georgia, USA. In Georgia, hunters have the opportunity to hunt three big game species: white-tailed deer (*Odocoileus virginianus*), eastern wild turkey (*Meleagris gallopavo*), and American black bear (*Ursus americanus*). However, deer is the most popular game species with 89% of hunters in Georgia pursuing deer in 2011 and the largest proportion (87%) of hunting occurring on some form of private land (U.S. Department of the Interior, 2011).

Survey and sampling design

A mail questionnaire was designed and implemented to collect data for this study. A preliminary questionnaire was pilot-tested among hunters, landowners, wildlife biologists, and private wildlife professionals who are knowledgeable of big game hunting and the lease business in Georgia, and revised accordingly. One of the six sections in the questionnaire asked respondents to provide details regarding their three most

visited big game hunting sites in Georgia in 2012. The sites described could be land leased directly by them, land associated with a hunting club, their own land, a friend's or relative's land, or public land.

The sampling frame for this study included all licensed hunters (resident and nonresident) who had big game hunting privileges in Georgia in 2012. A database of 422,663 big game license holders was obtained from the Georgia Department of Natural Resource's Wildlife Resource Division to create the big game hunter sample. A stratified random sampling approach was developed to ensure that the sample was representative of the Georgia big game hunter population. This sampling procedure first involved determining the percentage of each of the 16 big game license types in the total population. Next, individuals from each license type were randomly selected into the sample based on their respective license type's share of the total population. Overall, the allocation of hunters into the sample was similar to the percentages based on license type. The sample consisted of 3,000 licensed Georgia hunters with big game privileges in 2012.

The questionnaire was administered following a modified version of Dillman's Tailored Design Method (Dillman, Smyth, & Christian, 2014). An initial mailing consisted of a personalized letter, the questionnaire, and a business-reply prepaid return envelope. This initial mailing was followed with a postcard reminder approximately three weeks later. A final mailing, including a follow-up letter and copy of the questionnaire, was sent to nonrespondents 2 weeks after the postcard reminder. No additional mailings or reminders were sent due to budget constraints.

From the 3,000 questionnaires mailed out, 663 were returned completed and 280 were returned as undeliverable, netting an adjusted response rate of 24%. Although less than desirable, this response rate is consistent with several recent surveys that utilized license holders as the sampling frame (e.g., Kyle, Norman, Jodice, Graefe, & Marsinko, 2007: 20% in South Carolina; Paudyal et al., 2015: 24% in Georgia; Shiedeler, Carter, Liese, & Serafy, 2015: 18% in Florida). Given the population of interest was specifically individuals who hunted big game in Georgia in 2012, 100 licensed respondents who did not hunt big game in 2012 were removed from the sample. From this remaining sample of 563 big game hunters, a screener question identified hunters who were club members in Georgia in 2012 (37%). Although the majority of hunting club members belonged to one club (89%), respondents were able to provide information on up to three club memberships they purchased. One tenth of club members (10%) were members of two clubs, whereas a small percentage were members of three clubs (1%). Multiple club membership entries from individuals were treated as additional observations with the correlation among a given individual's observation incorporated into the estimator' variance.

Hedonic pricing model

In a typical hedonic model, individual hunting club dues are modeled as a function of: (a) club-specific characteristics such as total membership and club rules regarding management, (b) site-specific characteristics such as land cover type and amenities present, and (c) location-specific characteristics such as proximity to nearby

populations centers. Accordingly, a general hunting club dues hedonic equation can be expressed as:

$$\ln(P_i) = \beta_0 + \sum_{c=1}^{C} \beta_c Club_c + \sum_{k=1}^{K} \beta_k Site_k + \sum_{l=1}^{L} \beta_l Location_l + \varepsilon_i$$

where P_i is the per person dues paid by club member i, $Club_c$ is the cth club-specific variable, $Site_k$ is the kth site-specific variable, $Location_l$ is lth location-specific variable, ε_i is the error term representing independent and identically distributed errors, and β_0, β_c, β_k, and β_l represent the parameter vectors to be estimated. In the majority of the lease hedonic literature, a semi-logarithmic specification of the dependent variable is used (Hussain et al., 2007; Livengood, 1983; Munn & Hussain, 2010; Rhyne et al., 2009).

Variable definitions

Variables used in modeling club dues are presented in Table 1. Following Livengood (1983) and Pope and Stoll (1985), the dependent variable was specified as club dues paid by each club member in 2012. Club-specific independent variables were examined to

Table 1. Definitions and descriptive statistics of variables used to model Georgia big game hunting club dues as a function of club attributes for a hedonic pricing model developed for Georgia hunters in 2012.

Variable	Definition	Mean	Median	*SD*
Club dues	Georgia per person big game hunting club dues in 2012 ($)	716.36	563.00	509.94
Size	Total size of the hunting club (acres)	845.60	470.50	971.50
Membership	Hunting club's total membership	10.87	8.00	9.12
Planted pine forest	Dummy variable, 1 = site's predominant forest cover type is planted pine, 0 = otherwise	0.24	—	0.43
Natural pine forest	Dummy variable, 1 = site's predominant forest cover type is natural pine, 0 = otherwise	0.13	—	0.34
Hardwood forest	Dummy variable, 1 = site's predominant forest cover type is hardwoods, 0 = otherwise	0.07	—	0.26
Mixed forest	Dummy variable, 1 = site's predominant forest cover type is mix hardwoods/pine, 0 = otherwise	0.56	—	0.50
Recent timber harvest	Dummy variable, 1 = timber harvested on site within last 10 years; 0 = otherwise	0.67	—	0.47
Food plots	Dummy variable, 1 = food plots present on site; 0 = otherwise	0.87	—	0.34
QDM	Dummy variable, 1 = Quality Deer Management practiced on site; 0 = otherwise	0.61	—	0.49
Developed camping	Dummy variable, 1 = developed camping (water, power) available on site; 0 = otherwise	0.33	—	0.47
Fishing ponds	Dummy variable, 1 = fishing ponds present on site; 0 = otherwise	0.26	—	0.44
Trophy index	Index from Boone and Crockett score data describing number of whitetail bucks harvested in a site's county from 2000 to 2010	49.28	39.00	32.86
Ridge and valley	Dummy variable, 1 = site located in ridge and valley physiographic region; 0 = otherwise	0.06	—	0.23
Piedmont	Dummy variable, 1 = site located in Piedmont physiographic region, 0 = otherwise	0.53	—	0.50
Upper coastal plain	Dummy variable, 1 = site located in upper coastal plain region; 0 = otherwise	0.29	—	0.45
Lower coastal plain	Dummy variable, 1 = site located in lower coastal plain region; 0 = otherwise	0.12	—	0.33
Metro distance	Straight line distance from hunting club to nearest metropolitan area (miles)	21.70	18.56	15.12

determine their effect on individual club dues. *Size* was specified as a continuous variable and was expressed in acres (Livengood, 1983; Pope & Stoll, 1985). Quadratic effects involving *Size* were also tested. With the notable exception of a choice experiment by Hussain, Munn, Hudson, and West (2010), which found a nonlinear relationship, limited research has explored nonlinearity with lease size. *Membership* was specified as a club's total number of members (Livengood, 1983). Similar to *Size squared, Membership squared* was considered to test for quadratic effects involving *Membership*.

Among the management-specific variables, a dummy variable (*Recent timber harvest*) was created. This variable took a value of 1 if timber on the club's site had been harvested within the last 10 years and 0 otherwise. Another dummy variable (*Food plots*) specified whether or not food plots were present on the club's site (Zhang et al., 2006). A variable, *QDM*, was created indicating whether or not the club practiced Quality Deer Management (QDM). Whether QDM is practiced is typically included in the marketing of leases by landowners and clubs (e.g., Georgia Outdoor News, Rayonier) and QDM is mandatory in some counties. However, little research has examined whether, or to what extent, the practice of QDM influences lease rate or club dues.

Site-specific variables related to forest cover type were also considered (Hussain et al., 2007; Munn & Hussain, 2010; Rhyne et al., 2009). The predominant forest cover type of each lease site was specified using four dummy variables (*Planted pine forest, Natural pine forest, Hardwood forest*, and *Mixed forest*). A *Trophy index* was specified to account for possible site quality differences between clubs in terms of the chances of harvesting a trophy buck (Munn & Hussain, 2010; Rhyne et al., 2009). In 2010, the trade publication Georgia Outdoor News constructed the index by compiling county B&C score data recorded from 2000 to 2010 (Kirby, 2010). Similar to other continuous variables specified, quadratic effects involving *Trophy index* were tested by including *Trophy index squared*. A developed camping dummy variable (*Developed camping*) identified whether or not the club possessed developed camping amenities such as power and running water (Zhang et al., 2006). *Fishing ponds* indicated whether or not fishing ponds were present on the club's site.

The hedonic model also considered location-specific variables. Similar to Rhyne et al. (2009), distance in miles (*Metro distance*) from the county centroid of each club to the nearest Georgia metropolitan area was determined using ArcGIS. Based on the 2010 U.S. Census, Georgia contained the following 14 metropolitan areas: Atlanta, Augusta, Savannah, Columbus, Macon, Athens, Gainesville, Warner Robins, Albany, Valdosta, Dalton, Brunswick, Rome, and Hinesville-Fort Stewart (U.S. Department of Commerce, 2010). Georgia's physiographic regions vary based on factors such as elevation, climate, and forest cover type (Turner & Ruscher, 1988). To account for possible differences among clubs based on Georgia's physiographic regions, dummy variables corresponding to each region were created (*Ridge and valley, Piedmont, Upper coastal plain, Lower coastal plain*). One club located in the Blue Ridge Mountain region of Georgia was grouped into the ridge and valley region due to these regions' similarities and a lack of additional mountain region observations. Estimated 2012 deer densities for both the Piedmont and upper coastal plain regions were 25–30 deer per square mile. For the ridge and valley and lower coastal plain regions, estimated deer densities in 2012 were 20–25 deer per square mile (Georgia Department of Natural Resources, 2014).

Hedonic model estimation

With hedonic regression, theory does not provide guidance on which functional form to choose. As a result, an appropriate functional form can be determined using Box-Cox tests. With simpler specifications, such as the log-linear functional form, hedonic price functions have been shown to perform better, especially when some of the attributes affecting price are unobserved or are measured with error (Cropper, Deck, & McConnell, 1988; Sopranzetti, 2015). After an empirically and theoretically appropriate hedonic model is chosen, marginal implicit prices for attributes related to hunting leases can be estimated by differentiating the hedonic price function with respect to each attribute of interest (e.g., lease size; Taylor, 2003). For example, when a linear functional form is chosen, implicit price for an independent variable is calculated simply as the variable's coefficient. When a log-linear specification is used, implicit price for a continuous variable is calculated by multiplying the variable's coefficient by the mean or median value of the dependent variable (Taylor, 2003). If a given independent variable (x) has both linear and quadratic terms, implicit price is calculated as:

$$\frac{dP}{dx} = (\beta_1 + 2\beta_2 x)P,$$

where $\beta_1$is the coefficient on the linear term and β_2 the coefficient on the quadratic term, with x and club dues (P) usually evaluated at their mean or median values. To determine the effect of a dummy variable in the logarithmic model, the variable's coefficient must first be transformed using a correction, (e^{β}—1), where e is the base of the natural logarithm and β is the coefficient (Kennedy, 1992). This product is then multiplied by the mean or median value of the dependent variable to calculate implicit price.

Results

Descriptive statistics

The final sample identified 230 Georgia big game hunting clubs in 2012. Observations with large per person dues (>$6,000) and large club size (≥6,000 acres) were treated as outliers and excluded from the sample. Average per person club annual dues were $716.36 with a median of $563, whereas the average size of a club was 845.60 acres with a median of 470.50 acres (Table 1). Clubs averaged just under 11 members with a median of 8 members. Overall, the summary statistics reported are similar to those obtained from comparable hunting lease studies in the South (Rhyne et al., 2009; Zhang et al., 2006). For further perspective, a recent descriptive analysis of Georgia hunting leases based on an unscientific online convenience sample of Georgia Outdoor News subscribers indicated an average lease price per hunter of $1,079, average club size of 934 acres, and average membership of eight in 2013 (Mingie & Mengak, 2014).

Factors correlated with hunting club dues

Results from the hedonic regression of club dues are presented in Table 2. A Box-Cox procedure determined an appropriate functional form for the hedonic model and

Table 2. Parameter estimates of Georgia big game hunting club dues hedonic model.

Variable	Coefficient	Std. error	VIF	Imp. price ($)
Size	0.0014***	0.0001	16.87	0.77
Size squared	−2.1E-07***	2.9E-08	11.82	—
Membership	−0.0942***	0.0117	12.13	−50.19
Membership squared	0.0011***	0.0002	8.34	—
Planted pine forest	0.0477	0.1521	3.55	—
Natural pine forest	−0.0193	0.1537	2.54	—
Mixed forest	−0.0708	0.1433	3.97	—
Recent timber harvest	0.0633	0.0775	1.27	—
Food plots	0.2205*	0.1134	1.10	176.71
QDM	0.0384	0.0786	1.20	—
Developed camping	−0.0168	0.0771	1.32	—
Fishing ponds	−0.0769	0.0916	1.12	—
Trophy index	0.0086**	0.0037	12.63	2.47
Trophy index squared	−5.2E-05**	2.2E-05	10.83	—
Ridge and valley	−0.1453	0.1371	1.18	—
Upper coastal plain	−0.0761	0.0920	1.58	—
Lower coastal plain	−0.0685	0.1532	1.94	
Metro distance	0.0011	0.0024	1.53	
Intercept	5.8860***	0.2312	—	—
Number of observations	208			
F-statistic	15.851			
Adjusted R-squared	0.498			

Note. Dependent variable is the natural log of per person club dues. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Clustered standard errors are reported. Implicit prices are evaluated at the mean value for club dues.

identified a lambda value near zero. Therefore, a log-linear specification was used. Overall, nine of the 18 independent variables in the model were statistically significant at the 10% significance level. It took 10% as cutoff value or decision criteria in hypothesis testing because unlike in large sample studies, this study involves a small enough sample size ($\underset{\sim}{<}$ 200) to have significant impact on the outcome. A lower significance level is typically used in analysis involving larger sample sizes (Vaske, 2008). The model's adjusted R^2 value indicated that roughly half of the variation in per person club dues was explained by the independent variables. Given that multiple hunting club entries from single individuals were treated as additional observations, the data cannot be considered truly independent. As a result, clustered standard errors are reported (Petersen, 2009). A Pearson correlation matrix and Variance Inflation Factor (VIF) indices were used to check for multicollinearity (Greene, 2012). The correlation matrix indicated no strong correlations between any pair of independent variables, and no VIF score above 10 was reported except for variables with associated quadratic terms. Given that factors above 10 are common when quadratic terms are used, multicollinearity was not considered a concern. Given data constraints regarding lack of information on the exact location of leases identified, tests for spatial autocorrelation (Anselin, Bera, Florax, & Yoon, 1996) were not conducted.

Size was correlated with club dues through a significant and positive acreage term and a significant and negative acreage squared term, indicating that lease size and club dues were quadratically related. The implicit price of an increase in acreage on club dues thus varies by acres. For example, at the mean size of 845.60 acres, an increase of one acre led to an increase of $.77 in expected individual club dues or .11%. Combining the increase across the mean number of 10.87 members yielded an aggregate increase of $8.37 per acre. The effect of lease size on club membership dues is shown in Figure 1. This graph indicates a

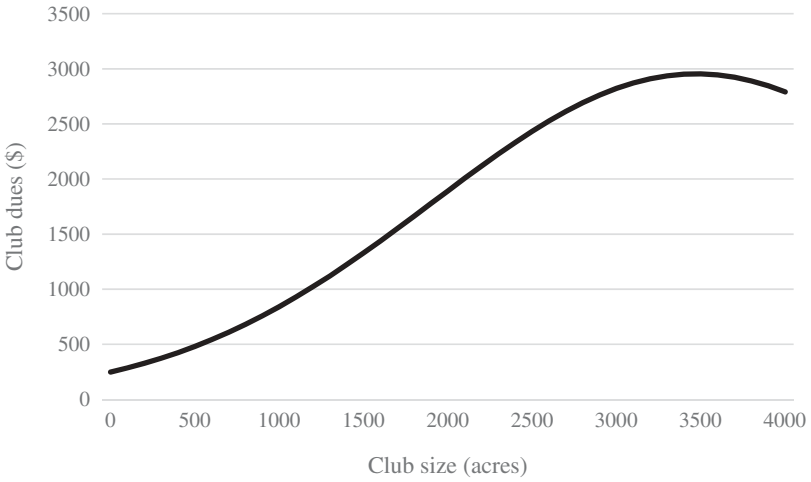

Figure 1. The effect of lease size on hunting club dues identified by the Georgia hunting club dues hedonic model estimated for Georgia hunters in 2012.

strong positive relationship between lease size and club dues from zero to roughly 2,500 acres. The curve begins to flatten out after 3,000 acres and an inflection point is reached near 3,500 acres. This graph in Figure 1 demonstrates that individual club dues first increase at an increasing rate with acreage and then decline after a threshold is reached.

Membership was negative and significant, suggesting that each additional lease member could be associated with a $50.19 or 7% decrease in dues on average. Alternatively, when evaluated at median values for membership and club dues, each additional lease member decreased dues by $43.13 or 8%. The effect of membership size on club membership dues is shown in Figure 2, which indicates a strong negative relationship between membership

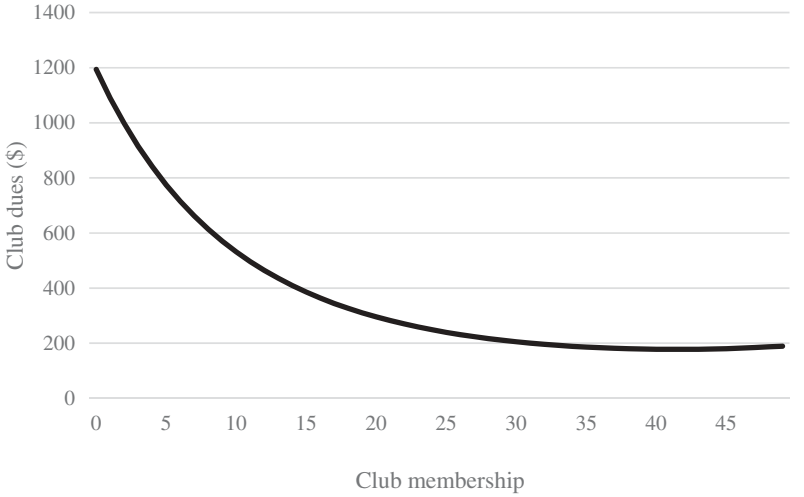

Figure 2. The effect of membership on hunting club dues identified by the Georgia hunting club dues hedonic model estimated for Georgia hunters in 2012.

and club dues from two to approximately 20 members. At approximately 25 members, the curve begins to flatten out. The figure demonstrates that the effect of increasing membership on club dues was negative. However, the effect of added members on club dues diminished with larger membership sizes.

Among the variables representing site-specific characteristics and management factors, *Planted pine forest, Natural pine forest*, and *Mixed forest* were insignificant. These results indicate no significant differences in club dues existed among forest types compared to the reference level (*Hardwood forest*). *Recent timber harvest* was also insignificant, suggesting no significant difference in club dues among clubs that experience a normal management practice and those that do not. *Food plots present*, however, was positive and significant (p = .053). This result indicates that supplemental nutrition management was positively correlated with club dues. The presence of food plots on a site increased club dues by $176.71 or 25%, on average. Using the median value for club dues, the implicit price for foods plots is $138.89. *QDM* was insignificant, indicating that club dues may not be influenced by practicing QDM. However, there are many management recommendations associated with QDM, but no clear standard defining QDM. As a result, QDM can mean something different for each individual hunter. Given this variable's inherent ambiguity, the interpretation of its result is unclear. *Trophy index* was positive and significant (p = .020), whereas *Trophy index squared* was negative and significant (p = .017). These results indicate that club dues increased with increasing index values, but at a decreasing rate for sites located in counties with large index values. Evaluated at the mean value for club dues, each additional index score increased club dues by $2.47 or .35%. Using the median value for club dues, the implicit price becomes $2.56. Site amenities, such as *Developed camping* and *Fishing ponds*, were both insignificant.

Compared to the Piedmont region, *Ridge and valley, Upper coastal plain*, and *Lower coastal plain* were insignificant, indicating that physiographic region did not significantly influence hunting club dues. This result may potentially be due to similarities in deer densities. In addition, differences in physiography may have been partly captured by the trophy index variables. *Distance to metro* had an insignificant effect on club dues. This result indicates that club proximity to population centers was not correlated with club dues. However, club proximity to a hunter's residence potentially had an effect on club choice. The average distance from a hunter's residence to his or her hunting club was 85.19 miles. In addition, nearly 75% of hunter residences in the sample were within 100 miles of their hunting club. This information suggests that proximity to residence and travel costs were potentially more important to hunters than a club's proximity to an urban center.

Discussion

This hedonic analysis of big game hunting club dues in Georgia indicated that lease size, membership, presence of food plots, and game quality were significant predictors of individual club dues. The positive effect of lease size and the negative effect of club membership on club dues were consistent with previous studies (Livengood, 1983; Pope & Stoll, 1985). Unlike previous studies, significant quadratic relationships involving these two lease attributes and club dues were identified. In contrast with per acre lease rate studies (Hussain et al., 2007; Munn & Hussain, 2010; Rhyne et al., 2009), forest cover type

had an insignificant effect on club dues. One explanation for this result involves the imprecise and coarse variable definitions used. Rhyne et al. (2009), for example, defined each site's percentage of hardwood and pine forest out of each site's total acreage. As an alternative to forest cover type, a deer density variable was constructed to account for potential habitat differences. However, this variable was also insignificant. With the exception of Hussain et al. (2007), previous studies have generally not examined the effect of forest management on lease rates or club dues. Results from the present study indicate that a typical forest management activity, such as timber harvesting, had an insignificant effect on club dues.

Consistent with the lease rate study by Zhang et al. (2006), the presence of food plots had a positive effect on hunting club dues. This result indicates that efforts to increase a site's quality by providing supplemental nutrition may have a positive effect on club dues and hunter WTP. Limited research has examined the effect of buck harvest regulations or wildlife management approaches on lease rates or club dues. The insignificant effect of QDM demonstrates that the variable's ambiguity likely contributed to its insignificance given that individual hunters can define QDM differently. Results from this study corroborate findings of Rhyne et al. (2009) and Munn and Hussain (2010) that suggest game quality positively affected club dues. Although this variable was able to control for differences in game quality in counties across the state, the variable's definition does not lead to a clear management implication. Results concerning the effect of site amenities were consistent with previous studies. For example, similar to Pope and Stoll (1985) and Messonier and Luzar (1990), the presence of fishing ponds and developed camping facilities had an insignificant effect on club dues.

Although previous studies, such as Rhyne et al. (2009) and Hussain and Munn (2010), indicated the possibility of multiple submarkets within a state, club dues were not significantly different for each physiographic region of Georgia. Although these regions vary in terms of topography and deer densities, the regional differences may have been partially captured by other indicators of deer quality, such as *Trophy index* variable. In contrast with the present study, previous studies have found that proximity to urban areas significantly influences lease price, with Pope and Stoll (1985) reporting a negative effect and Rhyne et al. (2009) and Shrestha and Alavalapati (2004) reporting a positive effect. Although straight line distance to a nearest metropolitan area was ultimately chosen (Rhyne et al., 2009), another specification considered involved using recent Rural-Urban Continuum Codes. However, results using this specification were also insignificant, suggesting that proximity to urban area may not matter when the model controls for a number of other variables affecting club dues. Nevertheless, factors such as proximity to residence and travel costs may be more important considerations for hunters when choosing a club rather than a club's proximity to an urban area. Hence, it may be useful for future studies to investigate how hunters consider distance to lease sites when making club membership decisions.

Comparable to similar hunting lease hedonic studies, nearly half of the variation in club prices was explained by the hedonic model. For example, adjusted R^2 values achieved by similar studies include .34 (Rhyne et al., 2009), .43 (Pope & Stoll, 1985), and .55 (Messonier & Luzar, 1990). Findings from this study contribute to this body of knowledge by examining factors affecting club dues as opposed to lease rates. Previous studies used data collected from landowners (Hussain et al., 2007; Zhang et al., 2006) or government

sources (Hussain & Munn, 2010; Rhyne et al., 2009) to model factors affecting per acre lease rates, whereas this study utilized hunting club data supplied by hunters themselves. From the demand perspective, hunters are not necessarily interested in the per acre rate of a lease since many choose from available club listings and pay annual club dues for hunting access rights. Arguably, focusing on hunting club dues allows for an improved interpretation of hunter willingness to pay for access rights.

Results from the hedonic model have potential implications for hunting club managers and lease hunting providers among corporate and noncorporate landowners. Although many private forest landowners are likely constrained by the amount of land they can devote to a hunting lease and the market availability of surrounding land, results suggested that each additional acre added increased annual club member dues by approximately $0.77. Taking into account average membership size, this yields an aggregate increase of $8.37 per acre. For private timber companies, such as Weyerhaeuser, a greater understanding of hunter WTP for lease size can help in setting lease sizes that increase profit for the company's entire land base. The effect of increasing membership size on club dues showed that adding one member decreased annual club dues by approximately $50. Although adding membership can increase revenue, hunters were found to prefer fewer members, indicating that hunters favor avoiding crowded conditions and having to compete for available game. It may also indicate increased social complexity associated with additional hunters. Although site improvements such as food plots were preferred by hunters, considerable costs are associated with creating and maintaining food plots. For example, in addition to costs for equipment, fuel, or labor, periodic costs associated with establishing and maintaining food plots (e.g., lime, fertilizer, seed, herbicide) can typically range from $160–213 per acre in 2012 dollars (Harper, 2008). Although our results indicate that hunters might pay a premium for sites with established food plots, more detailed studies are needed to precisely evaluate the economic efficiency of various types of food plots. Finally, game quality had a positive effect on hunting club dues based on the *trophy index*, although *QDM* was insignificant. These results suggested that game quality can have a significant effect on club dues, but the effect of different management practices is not easily identified. Of most significance to forest landowners, this study showed that typical forest management activities such as timber harvesting and other on-site forest-based amenities do not affect dues. This implies that lease hunting and timber management are largely compatible without no or negligible destruction to management operations. Accordingly, allowing lease hunting may not necessarily have conflict with timber harvesting operations (e.g., when, which plot to harvest).

As stated earlier, the leasing process in Georgia and surrounding states can be somewhat informal. The lease market could include a variety of players such as: (a) landowners seeking hunters or hunting clubs to lease their land for one or more seasons, (b) one or more hunters seeking to recruit other hunters and find a new lease, (c) lease an already identified land for one or more seasons, and (d) a stable club of close-knit members seeking a new lease for a period. Findings from this hedonic analysis will be of use in most cases. For example, landowners seeking to lease to hunting clubs can benefit from these results through understanding the value of establishing food plots, the expected impact of timber harvesting on lease value, and the tentative lease size that hunters may prefer. The hunting clubs with close-knit membership (static membership) that typically are seeking

to lease land can benefit from these findings to understand the tradeoffs they might face in finding hunting groups for their members. On the other hand, emerging clubs can use these findings to have a better idea of the maximum number of members a given lease site may sustain given the characteristics of the lease.

A few limitations of this study should be noted. First, a number of variables may have had somewhat different meanings to different respondents; examples include the forest type variables, *QDM*, and *Recent timber harvest*. The forest type variables might have been improved with more precise definitions involving percentages based on forest type. However, given that respondents were hunters and not landowners, the accuracy of these potential variables could have been questionable and may have induced higher nonresponse rates. Similarly, QDM can have an ambiguous meaning because there are many different recommendations and management activities associated with practicing QDM. Second, given the exact location of each hunting club was unknown, the hedonic model could not be tested for spatial autocorrelation. Previous studies examining hunting club dues have also not tested or accounted for spatial autocorrelation, which if present, can bias regression estimates. Hunting clubs located next to each other may have similar club dues because of similar resource and market conditions, as well as jointly managed harvest restrictions. Therefore, if possible, future models should control for such correlation.

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