

Valuing Characteristics of Transferable Deer Hunting Permits in Kansas

Justin Taylor
Graduate Research Assistant
Department of Agricultural Economics
Kansas State University
Manhattan, KS, 66506
phone: 785-532-6709
fax: 785-532-6925
email: jtaylor@agecon.ksu.edu

Thomas L. Marsh
Associate Professor
Department of Agricultural Economics
Kansas State University
Manhattan, KS, 66506
phone: 785-532-4913
fax: 785-532-6925
email: tlmarsh@agecon.ksu.edu

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Abstract

The novel use of transferable deer hunting permits in Kansas has altered property rights to a traditionally government rationed good, providing the institutional framework and incentives for competitive market activity. This paper investigates how attributes of the permit itself, spatial determinants, and the socioeconomic characteristics of the consumer-hunter influence market price. Findings provide valuable insight into factors that are important to Kansas interest groups, its economy, and to structuring transferable permits for wildlife programs.

Introduction

In 2000 Kansas implemented a transferable hunting permit program for deer. In effect, this program established the institutional framework and incentives to spawn a market for permits that were traditionally rationed through a lottery process. The beneficiaries of this program were intended to be private landowners (who provide nearly all the habitat for deer in Kansas). Concurrently, it has also opened the door for more nonresident hunters with the opportunity to attract additional revenue to the Kansas economy. As with any pioneering legislation, the new transferable permit program has come under heavy scrutiny from various interest groups. Conflicts have ranged from the specific design of the program to whether or not the program should exist at all. Given interest groups and wildlife management concerns, it has become imperative to better understand the market for transferable permits that has evolved since 2000 and implications to economic policy. In this paper we focus on the hunter-consumer to determine how they value characteristics for transferable deer hunter permits.

Previous studies have examined several aspects of wildlife markets. Sandrey, Buccola and Brown (1983) used a system of equations to determine the demand for antlerless elk hunting permits within the Oregon random lottery system. Their goal was to determine if the allocation method could be improved and help the wildlife management program become more financially self-sufficient. They found that the greatest demand for antlerless elk permits was from low-income individuals who lived in rural areas. They also determined that there were four pricing options the state could consider. The first option is to maintain the current policy of charging \$23 per tag and using a random lottery. The second policy is a market-clearing price of \$89.62 per tag on

average. A third policy would maximize revenue by charging an average price of \$69.60. The last policy would be a two-tiered pricing policy that would allow those people willing to pay \$125.00 to purchase their permit outright and the remainder to enter a drawing.

Nickerson (1990) determined the effect of a change in user regulations on deer and elk hunting in Washington State. The demand for deer and elk permits was estimated with separate equations. The equations were estimated with ordinary least squares regression. The coefficients for permit supply, antlerless only, and weapons restricted variables were not statistically different from each other across the two separate equations. Nickerson concluded that the similarity of policy effects across animals may lead to better policy implementation in the future.

Buschena, Anderson and Leonard (2001) estimated the marginal value of elk hunting permits by using the preference points system within Colorado's modified lottery. The authors use a hedonic pricing model to quantify the effects of hunt characteristics. Hunt characteristics included weapons restrictions, probability of success, gender restrictions, accessibility of sites, congestion of hunters, proximity to urban areas, and the probability of harvesting a trophy bull. Results from the Poisson regression indicated a marginal willingness to pay of \$41.81 for resident hunting permits in 1997. Non-resident hunters had an estimated willingness to pay of \$274.56.

Huffaker (1993) presented a decision model for managers to determine optimal deer harvest in order to maximize the net present value of fee hunting operations. He illustrates how properly adjusted hunting rates can control the cyclical nature of deer

populations and vegetation concentrations. He determined that the ability of managers to reach or maintain this optimal population depends on the flexibility of regulations.

The objective of this paper is to estimate the value of characteristics for transferable deer hunting permits in Kansas. To do so, we use a hedonic regression model to examine how permit specific attributes, spatial and demographic determinants, and socioeconomic characteristics of the hunter influence permit price. Results are based on data acquired by surveying over 1,200 hunters that participated in the Kansas transferable hunting program from 2000 to 2002. We find that permit characteristics provide valuable insight that can enhance structuring of wildlife management and transferable permit programs. Moreover, given much speculation about the market for transferable permits and its impact on interest groups, these results provide substantive information on which to base future policy recommendations on wildlife management.

This paper is presented in six sections. First is a background of deer management policy in Kansas and the transferable permit program. Second is breakdown of the data collection process and descriptive statistics for the data set. The third section presents the empirical model and statistical testing. The fourth section is a discussion and interpretation of the presented model. The last two sections provide implications and concluding remarks.

Background

In Kansas, progressive management practices along with improving habitat have helped deer herds recover from near devastation of the early 1900's to now over abundant herds with a reputation for trophy whitetail and mule deer bucks. In 1994 the first non-resident nontransferable deer hunting permits were made available. Non-resident hunters were

allocated 5% of each unit's rifle permits and 5% all archery permits. These permits were only available through a lottery process.

In 2000, Senate Bill 568 with amendments (hereafter SB568) was passed by the Kansas legislature. This bill created transferable deer hunting permits, dramatically altering the way non-resident hunting permits were allocated. The transferable permits allowed a landowner to apply through a lottery for a non-resident permit and, if successful, the opportunity to transfer that permit to any person with or without compensation. Initially, the landowner lottery consisted of fifty percent of all available non-resident permits that were allocated heterogeneously across the eighteen Kansas deer management units. To offset the decrease in the number of permits directly available to non-resident hunters SB568 doubled the allowable percentage of non-resident rifle permits and tripled the available archery permits. Overall, SB568 established property rights that provided incentives for landowners to transfer deer permits to hunters in a competitive market environment.

For completeness, we provide additional details about the transferable permit system in Kansas. Transferable permits were designed with the purpose of providing landowners compensation for damages caused by deer. Landowners are any person in the state of Kansas who owns or manages eighty acres or more for agricultural purposes. Ninety-seven percent of the land in Kansas is privately owned (KDWP) and hence landowners bear the majority of the cost for providing deer habitat. Landowners may apply for a rifle, muzzleloader, or archery permit using the lottery system. The cost of a permit in the random draw lottery to the landowners was \$205.50. If the landowner receives a rifle or muzzleloader permit it is valid for the deer management unit in which

their land is located. If an archery permit is awarded it may be used anywhere in the state. Additional permit restrictions exist for what type of animal (species and sex) may be harvested as well as the dates of the specific season. Once the landowner has received the permit they can transfer that permit (with or without compensation) to a hunter or use the permit themselves. All transfers are processed through the KDWP main office and are final. That is, a transferred permit can not be retransferred to another individual.

Data

Given the novelty of the Kansas transferable deer permits, primary data on price and other information were acquired by surveying hunters participating in the program in 2000, 2001, and 2002. A 26 question survey was developed, pretested, and then mailed to 1,219 hunters. Specific information about hunters participating in the Kansas transferable deer permit program was provided by Kansas Department of Wildlife and Parks. Questions inquired about the price paid for their permit, what services were included with the permit as well as other general socioeconomic and demographic information. The response rate from these surveys was 35.1%. However, each survey allowed for multiple responses from individuals who were repeat participants, yielding 687 hunter observations. For example, an individual hunter may have participated in the transferable deer hunting program in 2000 and 2002, but not in 2001, thereby providing two observations.

Descriptive Statistics

Table 1 provides descriptive statistics from the survey data collected. The mean permit price reported by hunters was \$760.13. The distribution of permit prices is provided in Figure 1. Over 250 of the permits were purchased for \$200.00-399.00. More

than 60 of the permits were sold for less than \$200.00. Plausible reasons for landowners selling a permit at a loss were when the permit was transferred to an existing customer (lessee) of the land or to a relative. About 100 (50) permits were sold in the range of \$400.00 – 599.00 (\$600.00 – 799.00) with the remaining permits mostly between \$1,000.00 and 1,599.00. *It is important to point out that the permits selling for higher prices often do not reflect the value of the permit itself.* For example, 36% of these permits were sold through a guide service and many were part of a hunting package made up of a bundle of hunting services. Not recognizing other services distorts the perception of how consumers value transferable deer permits.

Turning to the other variables reported in the survey. Approximately 50% of the observations collected were from 2001, while 22% were purchased in 2000 and 28% in 2002. This is primarily due to the structure of the KDWP database of hunters. The year 2000 marked the first offering of transferable permits, while the complete 2002 data was not available when the survey was prepared. Therefore a complete list of the 2002 hunters was not included, but rather any observations that were reported in 2002 were from hunters in either the 2000 or 2001 database (i.e., repeat participants).

Previous research (Marsh and Taylor 2002) demonstrated that the number of Kansas deer hunting permit applications differed significantly based upon geographic location. Figure 2 illustrates the difference in permit price by deer management unit. Figure 3 provides a map of the Kansas deer management units. It is evident that permit prices increase from Northeast (e.g., Units 8 or 9) to Southwest (e.g., Units 16, 17, or 18). This price change is mirrored by significant geographical changes in the state and by larger agricultural land holdings. Hence, unit dummy variables were incorporated into

the model in order to capture the spatial differences across the state. The state of Kansas is separated into 18 deer management units for rifle and muzzleloader permits. Archery permits cover the entire state. All of the deer management units are represented in this sample. Units 6 and 13 have the fewest number of observations; each comprises less than 3% of the sample. Unit 16 has the largest proportion with 12% of the sample.

Information about services that hunters purchased for the hunt was gathered as well. Over 75% of the individuals surveyed purchased some type of hunting services. Hunters either purchased their services on their own or they were purchased with the permit. Approximately 36% of the hunters purchased services with their permit. Room, board, and field guide were the services included with the permit purchase most often (29%, 23%, and 19% of the hunts, respectively). Approximately 40% of those surveyed purchased hunting services separate from their permit. The services purchased separately were primarily room, board, and field guide.

Land access is an important concern for hunters in Kansas because land is predominately privately held. In order to understand the prevalence of fee access, land leases were included as a separate question apart from other services. Approximately 13% of the hunters in this survey purchased some type of land access separate from their permit purchase. Alternatively, Walk-In-Hunting Access (WIHA) is a program the KDWP implemented to increase the amount of public access hunting in the state. Properties throughout the state are leased by the state and opened to any hunter for specific types of game. Hunters were asked if they used any WIHA properties during their hunting trip. Over 20% of the hunters surveyed used WIHA.

The type of weapon restrictions associated with a permit is critical for a hunters choice in hunting dates as well as species. Rifle hunting is the predominant method in this sample. The sample consists of 70% rifle permits, 20% archery, and 10% muzzleloader.

Determining how the transferable permits are sold is an important step in understanding the beneficiaries of this program. Importantly, economic intuition suggests that intermediate agents may enter the market for transferable permits to reduce transaction costs between buyers and sellers. For example, transaction costs may arise because landowners and hunters have limited information about one another and both have opportunity costs of time. Alternatively, guide services provide just such information. Landowners sold 58% of the permits in this sample. Sales through a commercial guide make up most of the remaining sales with 36%. The sales price of internet auctions are highly visible. However, they comprise less than 2% of the permits sold in the sample.

Two interaction variables are included in the data set to provide additional insight into the role that guides have played in the transferable permit market. These variables differentiate customers who purchased hunting services separate that are not included in the permit price. The variable *Guide*Separate Services* designates hunters who purchased their permit from a commercial guide and purchased additional hunting services separately. Those services may or may not have been provided by that guide, but are not included in the reported permit price. The variable *Land*Separate Services* reflects the hunters who purchased permits from a landowner and purchased additional

hunting services separately. *Guide*Separate Services* represents 23% of the sample, while *Land*Separate Services* constitutes 15% of the sample.

Demographic responses show the diversity of the hunters surveyed. The largest proportion of the sample is in the 50-59 year old age group. Due to the small number of observations in the categories *Age 1* (years 12-17), *Age 2* (years 18-29), and *Age7* (\geq year 70), we combined these into categories *Age1,2* (years 12-29) and *Age6,7* (\geq year 60). Employment was broken down into 7 categories, with almost 60% of the respondents employed as a manager or professional. The mean education level of this sample is between 13 and 15 years of formal education. Average household income was measured in 13 categories ranging from less than \$10,000 to greater than 250,000. Approximately 24% of hunters surveyed had income between \$50,000 and 75,000. Another 31% had income between \$100,000 and 200,000, while almost 15% of the permits were purchased by hunters with income in excess of \$200,000. Over 80% of the hunters surveyed have 20 years or more of hunting experience.

Empirical Results

A linear price model was estimated with ordinary least squares regression in Intercooled Stata 6.0 (Stata). The initial model, or Model 1, accounted for the complete set of variables presented in Table 1. Results of the final model, or Model 2, are provided in Table 2. A joint F-test of thirty-two different variables indicated they had no statistical impact on the permit price and were subsequently dropped from the model. A complete set of hypothesis tests (i.e., F-tests) supporting the zero restrictions in Model 1 to form Model 2 are reported in Table 3. The R-squared (goodness of fit measure) indicates the variables in Model 2 explained 39% of the variation in permit prices, which is typical of

cross-sectional data sets. Tests for heteroskedasticity indicated that the error term was heteroskedastic; the F-Test in Table 3 shows we reject the null hypothesis that the squared error is independent of the predicted price and the predicted price squared. Therefore, statistical tests are based on White's robust standard errors (Maddala). For robustness the model was also reestimated using a Box-Cox procedure to transform the dependent variable. The results were nearly identical to the linear model reported in Table 2.

Discussion

In the price regression model specified for this study, the value of the constant term reflects the value of a transferable hunting permit to the representative hunter. *The representative hunter is someone who purchased a rifle permit for Unit 1 (northwest region of Kansas) in 2001. This permit was purchased from a landowner and included no other services in the permit price. The representative hunter did not purchase any other hunting services, including a land lease. This hunter is 50-59 years old with \$50,000 to 75,000 annual income and has 13-15 years of formal education.* The constant term is positive and significant, implying the value of the permit to the representative hunter is \$568.63. Given the other variables are discrete in nature, the coefficients on the other characteristics represent a shift (increase or decrease) relative to the price of the representative hunter.

Year

The use of the transferable permit program has increased as landowners and hunters have become more aware of its existence. The positive and statistically significant coefficient for 2002 indicates that permits sold in 2002 were worth \$116.00

more than those sold in 2001. This may be due to an increased awareness of the Kansas transferable permit program.

Unit

Units 16, 17, and 18 are located in the southwest corner of the state (see Figure 3). This region, more than any other in the state, has developed a reputation for raising trophy whitetail and mule deer bucks. The reputation effect combined with several high profile hunting videos that have been filmed there seem to have fueled the demand for hunting permits in the region. The positive and statistically significant coefficients indicate that hunters are willing to pay \$394 to 500 more for a permit in the southwest region of the state relative to the representative hunter in Unit 1 (northwest region of Kansas). The significant and negative estimated coefficients for Units 7, 8, and 9 indicate that hunters paid less for a permit in these units relative to a permit in Unit 1. These units are located in the northeastern portion of the state where mule deer hunting is decreased or not available and landholdings are smaller, which may help explain the lower market value in this region. Units 12, 13, and 15 also have significant and negative coefficients. These units are located in the southeastern portion of the state and again mule deer hunting is not available and land holdings are smaller relative to the western portion of the state. The remaining units in the state do not attract a statistically significant premium or discount relative to Unit 1.

Permit Type

As described earlier, a landowner may receive a rifle, muzzleloader or archery permit. Each weapon type has different probability of successful harvest as well as season dates. There are two other important differences. First, rifle and archery permits

are only valid for whitetail either sex where muzzleloader permits are valid for any deer. Second, rifle and muzzleloader permits are only valid for one unit; archery permits are valid anywhere in the state.

The positive and statistically significant coefficient for muzzleloader indicate that hunters are willing to pay a premium of \$235.38 for the earlier season and harvest flexibility associated with this permit type. Despite the longer season provided with an archery permit the statistically significant and negative coefficient for archery shows that hunters pay \$205.94 less for an archery permit than a rifle permit. Archery hunts are typically more physically demanding and time consuming than rifle with much lower success rates. Non-resident hunters may discount this permit because there time is relatively fixed and the lower success rate associated with archery may significantly decrease their probability of harvest.

Marketing Method

Initially, the transferable permits were intended to provide a direct transfer from landowners to hunters. However, this is not the only method that occurred in the market. As demonstrated by the descriptive statistics, many landowners consigned their permit to a commercial guide or some other agent to handle the actual sale. Others enlisted the services of a broker or list the permit on an internet auction in order to complete the sale.

In order to estimate the impact third parties have on permit prices four marketing variables were included in the model. Coefficients for guide and internet sales are statistically different from landowner sales. Permits sold through a guide are estimated to sell for \$488.31 more than those sold directly from a landowner. The few permits sold via the internet attracted a premium of \$356.12. The remaining permits that are sold

though a broker or some other method do not sell for a price statistically different from the direct landowner sales.

Services

Transferable deer permits are sold with various services and forms of transactions. Many of the permits are transferred directly from a landowner to a hunter with no services or land access included in the permit price. Other permits are sold as part of an all inclusive hunting package. In order to estimate the value of the permit alone we have included several variables to account for the value added by other services.

Based on the survey results, Board, and Field Guide are two of the primary services included in the purchase price of the transferable permits. The premium for board services is statistically significant and estimated to be worth \$377.50. Including field guide services with the permit significantly increases the price paid by \$307.44. The majority of the hunting packages sold are 5 to 7 day hunts. Therefore the daily value of board and field guide services is approximately \$63 and 51, respectively.

Many hunters who purchase their permit hired a field guide or purchase other services separately. The cost of these separate services was not included in the permit price. We anticipated that a hunter who purchased a permit in this fashion would pay less for their permit. Exactly how much depends on the individual hunters opportunity cost of time as well as how much time it takes to secure the desired services. In order to estimate the impact of purchasing these additional services, the two interaction variables were used. Of all the hunters who purchased services separately 97% of them purchased their permit from a guide or a landowner. The statistically significant and negative coefficient for *Guide*Separate Services* indicates that a hunter who purchased their permit from a

guide and then purchased services separately paid \$507.22 less for their permit than the representative hunter.

The similar yet opposite magnitude of the coefficients for *Guide* and *Guide*Separate Services* indicates that these two variables may offset each other. Therefore, we tested the null hypothesis that the net impact on permit price is zero when a hunter purchases a permit through a guide but purchases additional hunting services separately (Table 3). The F-test suggests that permits purchased in this manner sell for the same price as permits purchased from a landowner. The coefficient for *Land*Separate Services* was not statistically different from zero and was excluded from the final model.

One service that many hunters in Kansas purchase is land access. Land access is commonly purchased through some type of lease arrangement with a landowner. Some landowners will transfer a permit to their lessee for little or no additional fee. This relationship allows the hunter to increase their probability of receiving a permit. This transaction method appears to hold as the statistically significant coefficient for land lease shows that a hunter who leases property will pay \$181.01 less than a hunter who does not. The state sponsored land access program WIHA did not have a statistically significant impact on the permit price paid.

Demographics

Individuals hunting in Kansas are a diverse group of people. They are located in 48 of the 50 states and work in all types of jobs. Three individual characteristics that have a statistically significant effect on their willingness to pay for deer permits are education, age, and income. Education level was measured in ranges from less than 12

years of schooling to graduate degrees. Hunters with less than a high school education are estimated to pay \$314.05 less than someone with some college education. Hunters with an undergraduate or graduate/professional college degree are also estimated to pay less for their deer permits, \$149.15 and 204.03 respectively.

Age was measured in 7 categories from 12-17 to greater than 70. The only age group that paid a price statistically different than the representative hunter is those who are 12 – 29 year old. These hunters pay approximately \$203.97 less than 50 – 59 year old hunters.

An individual's income is an important factor in their willingness to pay for a transferable permit. It was hypothesized that income will have a positive impact on permit price. Estimation of the hedonic model supports this hypothesis. Hunters with an income from \$150,000 to 174,999 and \$175,000 to 199,999 are estimated to pay \$271.79 and 380.94, respectively, more than hunters who earn \$50,000 to 74,999. Hunters with an income between \$200,000 and 225,000 are estimated to pay \$365.50 more than the representative hunter. Higher income hunters, those with income of \$250,000 or more, are estimated to pay a premium of \$319.67. We tested the null hypothesis that the income effect on permit price is the same over these four income groups (Table 3). We fail to reject the null hypotheses and determine there is no statistical difference in the price paid between the four higher income groups.

Implications

Senate Bill 568 (with amendments) mandated a transferable deer permit program in Kansas that allowed participating landowners an opportunity to sell permits to resident and nonresident hunters. Since 2000, much speculation and concern has arisen over the

impacts of this program on interest groups and deer management in Kansas. Results of this study provide information on how permit specific attributes, spatial and demographic variables effects, and socioeconomic characteristics of the hunter influence permit price.

Findings of this study have important policy implications. First, there are significant regional impacts. Permit prices in Southwestern Kansas (Units 16-18) range from \$350 to over \$700 higher than those in the remainder of the state. This suggests policy makers regulating transferable permits should carefully consider regional differences, given return to landowners is a policy objective. Second, weapon restrictions are also important. Hunters pay more (less) for muzzleloader (archery) permits relative to rifle, which imply weapon restrictions are economically important. Third, socioeconomic and demographic variables are also important. For example, hunters with higher income pay more for transferable permits. This is relevant because nearly 10% of the hunters are in the income category of \$250,000 or more. Fourth, services are an important part of pricing transferable permits. Board and field guide services increase the price of hunting packages and in turn bring revenue to Kansas providers.

Finally, there has been considerable speculation as to whether third parties are arbitraging the transferable permit market and capturing excess rents associated with the transferable permit program. As discussed above the cost of internet transactions was \$356 more than the representative hunter purchasing directly from a landowner. But only 2% of the hunters purchased permits via the internet. Broker's transactions were not statistically significant. Those hunters purchasing transferable permits through guides paid \$488.31 dollars more than the representative hunter. However guides only receive this additional premium if the hunter does not arrange their own services. Hence, we find

some evidence that guides are anticipating profits from value added services and not on average trying to arbitrage the transferable permit market.

Conclusions

This purpose of this study was to investigate the value of characteristics for transferable hunting permits in Kansas. Empirical results are based on data acquired by surveying over 1,200 hunters that participated in the Kansas transferable hunting program from 2000 to 2002. Regression analysis is used to quantify permit specific attributes, spatial and demographic variables effects, and socioeconomic characteristics of the hunter influence permit price.

The representative hunter paid \$568.63 for a transferable hunting permit. *The representative hunter is someone who purchased a rifle permit for Unit 1 (northwest region of Kansas) in 2001. This permit was purchased from a landowner and included no other services in the permit price. The representative hunter did not purchase any other hunting services, including a land lease. This hunter is 50-59 years old with \$50,000-74,999 annual income and has 13-15 years of formal education.* Importantly, permit prices can vary significantly relative to the price paid by the representative hunter. The largest premium (discount) for Kansas deer management unit is \$500 for Unit 18 (\$279 for Unit 8). Including services in the permit can increase the expected price by \$684. Hunters who lease property for hunting purposes pay \$181 less for permits. Muzzleloader permits are the most desired permits bringing in an additional \$235. Permits sold through a guide service sell for \$488 more than landowner permits. Permits sold to higher income hunters can sell for an additional \$381.

It is clear that changes to the transferable permit program must take into consideration the significant spatial differences across the state. Policy changes affecting the type of permits available will have differing affects on the beneficiaries of the program; as rifle, muzzleloader, and archery permits are valued differently. Moreover, service providers (i.e., guides) benefit from this program as well as landowners. Policy changes that limit there involvement in the market will likely alter revenues to the state of Kansas.

Future research will include estimation of the model presented as a double censored tobit model to determine if bias is created by limiting permit price during data collection. Landowner data gained from another survey will be incorporated into a model to further investigate the alleged arbitraging of the market by third parties.

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Tables / Figures

TABLE 1. Representative Descriptive Statistics from Hunter Survey (N=617). Except for permit price all variables are discrete, indicating 1 for Yes and 0 for No.

| Variable | Definition | Min | Max | Mean |
|------------------------|---|-----|------|--------|
| Permit Price | price paid by hunter | 200 | 3500 | 760.13 |
| Year 2000 | year permit was purchased | 0 | 1 | 0.22 |
| Year 2001 | year permit was purchased | 0 | 1 | 0.50 |
| Year 2002 | year permit was purchased | 0 | 1 | 0.27 |
| Unit 1 | location where permit was used | 0 | 1 | 0.08 |
| Unit 2 | location where permit was used | 0 | 1 | 0.04 |
| Unit 3 | location where permit was used | 0 | 1 | 0.06 |
| Unit 4 | location where permit was used | 0 | 1 | 0.03 |
| Unit 5 | location where permit was used | 0 | 1 | 0.04 |
| Unit 6 | location where permit was used | 0 | 1 | 0.01 |
| Unit 7 | location where permit was used | 0 | 1 | 0.05 |
| Unit 8 | location where permit was used | 0 | 1 | 0.05 |
| Unit 9 | location where permit was used | 0 | 1 | 0.04 |
| Unit 10 | location where permit was used | 0 | 1 | 0.04 |
| Unit 11 | location where permit was used | 0 | 1 | 0.09 |
| Unit 12 | location where permit was used | 0 | 1 | 0.11 |
| Unit 13 | location where permit was used | 0 | 1 | 0.02 |
| Unit 14 | location where permit was used | 0 | 1 | 0.11 |
| Unit 15 | location where permit was used | 0 | 1 | 0.04 |
| Unit 16 | location where permit was used | 0 | 1 | 0.12 |
| Unit 17 | location where permit was used | 0 | 1 | 0.04 |
| Unit 18 | location where permit was used | 0 | 1 | 0.04 |
| Room | service included in permit price | 0 | 1 | 0.29 |
| Board | service included in permit price | 0 | 1 | 0.23 |
| Field guide | service included in permit price | 0 | 1 | 0.19 |
| Separate service | services purchased separate from permit | 0 | 1 | 0.39 |
| Land lease | leased hunting property | 0 | 1 | 0.13 |
| Walk-In-Hunting | usage of state provided hunting access | 0 | 1 | 0.22 |
| Rifle | weapon restriction | 0 | 1 | 0.70 |
| Muzzleloader | weapon restriction | 0 | 1 | 0.10 |
| Archery | weapon restriction | 0 | 1 | 0.20 |
| Landowner | agent permit was purchased from | 0 | 1 | 0.58 |
| Guide | agent permit was purchased from | 0 | 1 | 0.36 |
| Guide*Separate Service | interaction term, purchased permit from guide and purchased services separately | 0 | 1 | 0.23 |
| Land*Separate Service | interaction term, purchased permit from landowner and purchased services separately | 0 | 1 | 0.15 |
| Broker | agent permit was purchased from | 0 | 1 | 0.02 |
| Internet | agent permit was purchased from | 0 | 1 | 0.02 |
| Other method | agent permit was purchased from | 0 | 1 | 0.02 |
| Age 1, 2 | hunter age, 12-29 | 0 | 1 | 0.04 |
| Age 3 | hunter age, 30-39 | 0 | 1 | 0.22 |
| Age 4 | hunter age, 40-49 | 0 | 1 | 0.30 |
| Age 5 | hunter age, 50-59 | 0 | 1 | 0.31 |
| Age 6,7 | hunter age, 60 and above | 0 | 1 | 0.13 |

TABLE 1. Continued

| | | | | |
|------------------|--|---|---|------|
| Education 1 | hunter education, <12 years | 0 | 1 | 0.03 |
| Education 2 | hunter education, 12 years | 0 | 1 | 0.20 |
| Education 3 | hunter education, 13-15 years | 0 | 1 | 0.33 |
| Education 4 | hunter education, 16 years | 0 | 1 | 0.29 |
| Education 5 | hunter education, >16 years | 0 | 1 | 0.16 |
| Student | hunter occupation | 0 | 1 | 0.01 |
| Worker | hunter occupation | 0 | 1 | 0.07 |
| Manager | hunter occupation | 0 | 1 | 0.36 |
| Farmer | hunter occupation | 0 | 1 | 0.08 |
| Professional | hunter occupation | 0 | 1 | 0.23 |
| Retired | hunter occupation | 0 | 1 | 0.11 |
| Other occupation | hunter occupation | 0 | 1 | 0.13 |
| Income 1 | hunter income, < \$10,000 | 0 | 1 | 0.01 |
| Income 2 | hunter income, between \$10-\$14,999 | 0 | 1 | 0.00 |
| Income 3 | hunter income, between \$15-\$24,999 | 0 | 1 | 0.02 |
| Income 4 | hunter income, between \$25-\$49,999 | 0 | 1 | 0.11 |
| Income 5 | hunter income, between \$50-\$74,999 | 0 | 1 | 0.24 |
| Income 6 | hunter income, between \$75-\$99,999 | 0 | 1 | 0.16 |
| Income 7 | hunter income, between \$100-\$124,999 | 0 | 1 | 0.13 |
| Income 8 | hunter income, between \$125-\$149,999 | 0 | 1 | 0.09 |
| Income 9 | hunter income, between \$150-\$174,999 | 0 | 1 | 0.05 |
| Income 10 | hunter income, between \$175-\$199,999 | 0 | 1 | 0.04 |
| Income 11 | hunter income, between \$200-\$224,999 | 0 | 1 | 0.03 |
| Income 12 | hunter income, between \$225-\$249,999 | 0 | 1 | 0.02 |
| Income 13 | hunter income, >= \$250,000 | 0 | 1 | 0.09 |
| Experience 1 | hunter experience, 1-5 years | 0 | 1 | 0.01 |
| Experience 2 | hunter experience, 6-10 years | 0 | 1 | 0.03 |
| Experience 3 | hunter experience, 11-15 years | 0 | 1 | 0.04 |
| Experience 4 | hunter experience, 16-20 years | 0 | 1 | 0.10 |
| Experience 5 | hunter experience, >20 years | 0 | 1 | 0.84 |

TABLE 2. Empirical Model Results From Ordinary Least Squares.

| Variable | Coefficient | Robust Std. Err. | t-stat |
|-------------------------|--------------|------------------|--------|
| Year 2002 | 116.0054** | 55.08317 | 2.106 |
| Unit 7 | -216.5724** | 93.0278 | -2.328 |
| Unit 8 | -278.7527*** | 61.64476 | -4.522 |
| Unit 9 | -147.8554* | 79.32563 | -1.864 |
| Unit 12 | -150.8674** | 74.30153 | -2.03 |
| Unit 13 | -259.4927** | 116.0275 | -2.236 |
| Unit 15 | -160.5708* | 87.06872 | -1.844 |
| Unit 16 | 409.3818*** | 96.30894 | 4.251 |
| Unit 17 | 394.3716** | 164.4078 | 2.399 |
| Unit 18 | 499.7746*** | 193.0381 | 2.589 |
| Muzzleloader | 235.3826** | 119.8469 | 1.964 |
| Archery | -205.9369*** | 51.27353 | -4.016 |
| Guide | 488.3118*** | 121.0553 | 4.034 |
| Internet | 356.1189** | 147.7231 | 2.411 |
| Board | 377.5046*** | 99.25276 | 3.803 |
| Field guide | 307.437*** | 107.4157 | 2.862 |
| Guide*Separate Service | -507.2216*** | 129.4853 | -3.917 |
| Land lease | -181.012*** | 54.128 | -3.344 |
| Walk-In-Hunting | -82.13746 | 56.67316 | -1.449 |
| Education 1 (<12 years) | -314.0493*** | 109.7731 | -2.861 |
| Education 4 (16 years) | -149.1476** | 62.4965 | -2.386 |
| Education 5 (>16 years) | -204.0302*** | 74.89249 | -2.724 |
| Age 1, 2 (12-29) | -203.9672*** | 79.14557 | -2.577 |
| Income 123 (<10-24,999) | 75.60189 | 130.5364 | 0.579 |
| Income 9 (150-174,999) | 271.7851** | 127.8553 | 2.126 |
| Income 10 (175-199,999) | 380.9423*** | 120.902 | 3.151 |
| Income 11 (200-224,999) | 365.4992** | 173.3381 | 2.109 |
| Income 13 (>=250,000) | 319.6688*** | 107.7953 | 2.966 |
| Constant | 568.6278*** | 55.92302 | 10.168 |

R² = 0.3871

n = 617

*indicates statistical significance at the 10% level

**indicates statistical significance at the 5% level

***indicates statistical significance at the 1% level

TABLE 3. F-Test Results

| Null Hypothesis | D.F. (n ₁ , n ₂) | F-Stat. | Critical F ¹ |
|---|--|---------|-------------------------|
| H ₀ : b _{phat} = b _{phat2} = 0 | (2,614) | 119.34 | 3.00 |
| H ₀ : b* = 0 ² | (32,556) | 1.20 | 1.46 |
| H ₀ : b _{inc9} = b _{inc10} = b _{inc11} = b _{inc13} | (3,588) | 0.16 | 2.60 |
| H ₀ : b _{guide} + b _{guide} *seperateservice = 0 | (1,588) | 0.11 | 3.84 |

1 95% Confidence Level

2 b* = (b_{y2000}, b_{unit2}, b_{unit3}, b_{unit4}, b_{unit5}, b_{unit6}, b_{unit10}, b_{unit11}, b_{unit14}, b_{room}, b_{ldsepserv}, b_{broker}, b_{otherm}, b_{age3}, b_{age4}, b_{age67}, b_{education2}, b_{student}, b_{worker}, b_{farmer}, b_{profes}, b_{retired}, b_{othero}, b_{income4}, b_{income6}, b_{income7}, b_{income8}, b_{income12}, b_{experience1}, b_{experience2}, b_{experience3}, b_{experience4})'

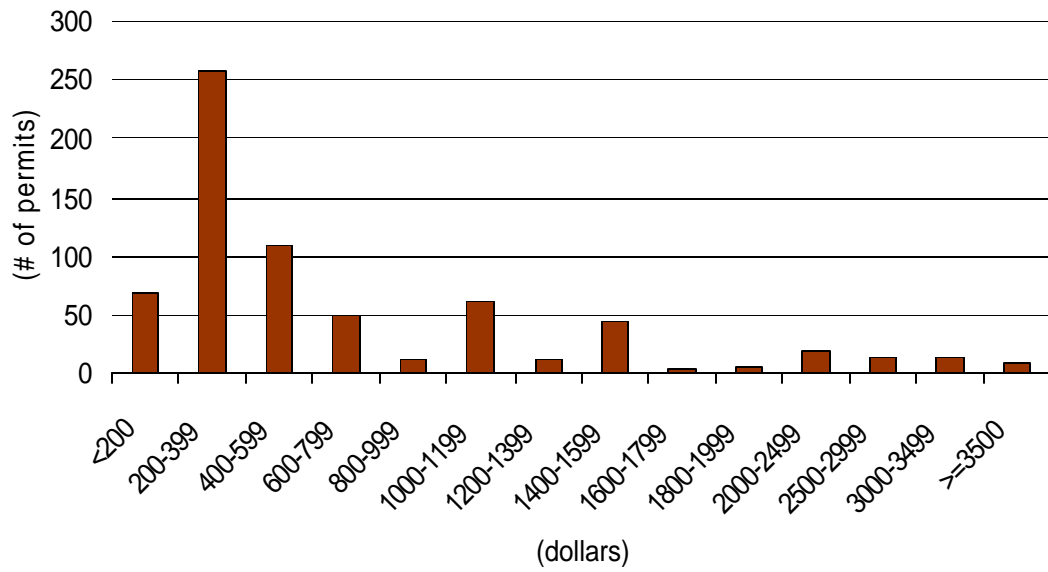


FIGURE 1. Distribution of Prices Paid for Transferable Permits by Hunters

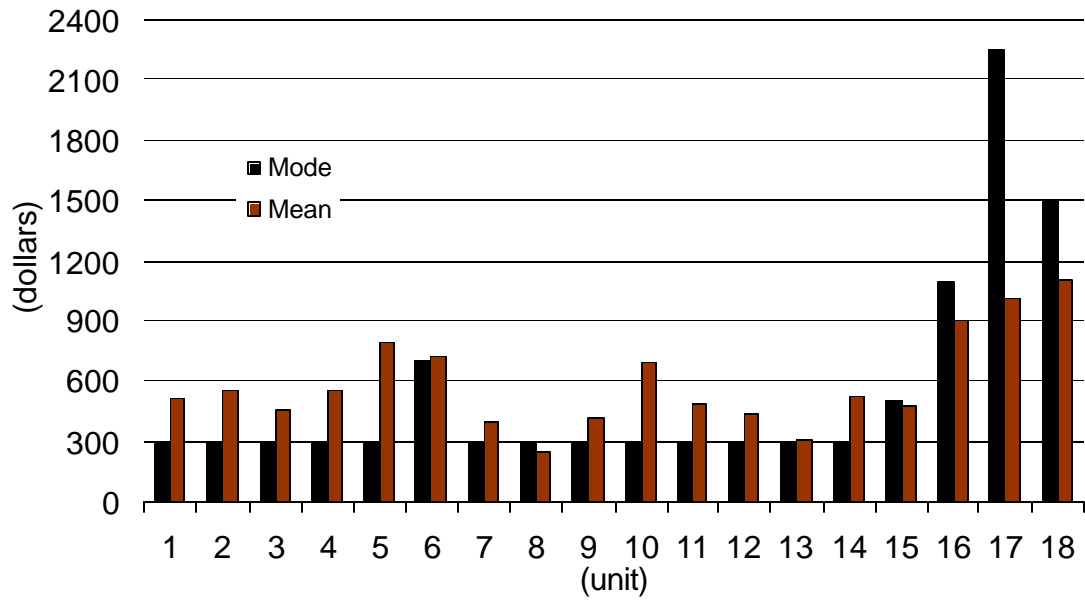


FIGURE 2. Mean and Mode of Permit Prices by Deer Management Unit