An Analysis of Hunting License Sales

and Conservation

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# Abstract

The goal of this project was to expand knowledge related to the effects of hunting license prices on sales. The hypothesis of, increasing hunting license prices will have no substantial adverse effect on sales and revenue, was accepted, since various studies on the price elasticity of demand of hunting licenses yielded the conclusion that hunting licenses are relatively inelastic economic goods. This inelasticity signifies that the number of licenses purchased is not sensitive to the price of licenses.

Due to hunting licenses’ inelasticity, it was concluded that a potential small license price increase would create no adverse effect on sales, ergo increasing revenue. This knowledge is very useful to wildlife agencies who have faced major decreases in revenue over the last decade. Furthermore, the extra funds generated from a small, proposed license price increase are required to go toward conservation efforts. These funds would thus help to create healthier wildlife populations and improve hunting conditions, benefitting both hunters and conservationists alike.

An Analysis of Hunting License Sales and Conservation

Statement Of Need

Hunters and anglers have historically been, and continue to be, the largest contributors to government wildlife conservation programs (Schummer, 2010). Humburg (2010) asserts that “in 2011, $14.6 billion was spent nationwide on licenses, fees, and membership dues” (p. 4). Much of these profits is spent to purchase dedicated fish and wildlife areas, while another portion is used to fund wildlife law enforcement activities.

However, in the last decade, annual hunting license sales have greatly declined in as many as 33 states (Regeher, 2011). The decline in license purchases suggests a downward trend in hunting as a whole, which, in turn, is causing a corresponding decrease in hunting expenditures. Hunting is declining because of urbanization leading to habitat loss, a loss of leisure time available for hunting, and a decrease in cultural hunting traditions based on changing nationwide demographics (Baumeister, Cunningham, Gude, & Herbert, 2012).

Between 2001 and 2010, the number of hunters fell four percent, reflecting lessening interest and prioritization of hunting compared to other pastimes that people must be participating in (Baumeister et al., 2012). Many have suggested raising license fees to generate more revenue as a result of the loss of revenue wildlife agencies endure because of decreasing hunter numbers (Brown & Connelly, 2004; Baumeister et al., 2012).

Many studies concerning the effect of hunting license prices on revenue are purely inductive, as they draw conclusions based on popular opinion or simple trends they notice without quantitative analysis. These studies are unreliable since demand must be calculated and analyzed in order to be deeply understood. Similarly, studies that do look into the elasticity of hunting licenses often do not apply their results in a conservation context, as they purely look at the economics behind licenses without considering the implications of their findings. There is a need for an elasticity study of hunting license prices’ effects on license sales while applying the results to the current issues of hunter participation and conservation.

Main Goal of Project

The governing question of this thesis is: “How does increasing hunting license prices affect license sales?” The purpose of this study is to further understanding related to hunting license prices’ effect on sales. With this knowledge in hand, the most effective strategy for modifying hunting licenses in order to create maximum revenue can be deduced. The hypothesis is: increasing hunting license prices will have no substantial adverse effect on sales and revenue. The sole subquestion is: “How can license structure be modified in order to maximize revenue?” The primary field of study is economics and the secondary field of study is conservation.

Methods and Evaluation

In order to find the effect that increasing license prices have on license sales, the researcher will be using a quantitative approach to calculate the price elasticity of demand for hunting licenses. Price elasticity of demand is calculated by dividing the percent change in quantity demanded (usually in sales) by the percent change in price. The elasticity can be expressed as:

The term *Q* denotes the quantity demanded, *P* denotes the market price, denotes the price elasticity of demand**,** andΔdenotes a (discrete) change in the price or quantity**.** The elasticity estimate is assumed negative since price and revenue are typically inversely related, as would be expected from a price/demand relationship (Poudyal, Cho, & Baker, 2008). However, for ease of interpretation, the elasticity estimate is often expressed as an absolute value. If the price demand of elasticity value, in absolute terms, is less than one, the relationship is referred to as inelastic, indicating a weak relationship between price and demand. Conversely, if the value is greater than one, the relationship is referred to as elastic, indicating a strong relationship between price and demand (Poudyal, Cho, & Baker, 2008). Intuitively, if demand is elastic, then the change in quantity demanded is proportionally larger than the change in price.

The researcher will gather data from public online license sale records kept by each state. These records keep track of the prices and numbers of licenses sold yearly in each state, and sort the sales by various categories such as age, sex, and resident/non-resident. The researcher will then construct a regression model using the individual state-by-state data points, and calculate the price elasticity of demand value for hunting licenses. The researcher will also calculate the price elastic of demand value while isolating different demographic variables to construe their effect on revenue.

Once the price elasticity of demand of hunting licenses in the United States as well as the ways demographics affect elasticity is calculated, the researcher will be able to evaluate the best course of action to be taken in order to maximize revenue to be used towards conservation efforts. The researcher will apply the findings to address the disconnect between certain demographics and participation in hunting in order to expand the group of people who are likely to purchase a license. If the researcher can come up with a feasible, effective plan to help remedy the revenue issue based on the factors assessed, then the research can be used for policy prescriptions to increase hunting and conservation efforts. The governing question will be valid if the effect of increasing hunting license prices can be inferred based on the model constructed, and whether increasing license prices will create more revenue.

Significance

The elasticity of hunting licenses is quite significant for conservation. Since all revenue garnered from hunting licenses goes toward conservation purposes, it is in the field’s best interest to fully exploit hunting licenses. Hunting licenses are a simple, effective way to create funds for wildlife agencies to be used toward conservation in order to mutually benefit hunters and wildlife. Since agencies have been faced with an extreme lack of funds in recent years; this study could provide essential information to not only create more license revenue, but also reverse the dismal trend hunting is experiencing as a whole. Also, by singling out specific demographics that are most responsive toward price changes, agencies can infer these demographics as not being effectively retained. These groups should be targeted by advertising campaigns and other efforts to improve retention and thus create more revenue.

Applicability

The effect of hunting license price on sales extends beyond the scope of this study. Knowledge of this relationship is very useful to wildlife agencies, as many previous elasticity studies on hunting licenses are outdated, and purely from an economic standpoint, not from a conservation view as well. Results from this study along with more demographic information could be used to help remedy the revenue issue plaguing wildlife agencies by specifically targeting low-retention groups. Findings from this study can likely be applied to fishing licenses as well since, although fishing as a sport is not experiencing a steep decline like hunting, there is always a need for more revenue, and the elasticity relationship from this study holds true within that context as well.

Chapter II: Review of Literature

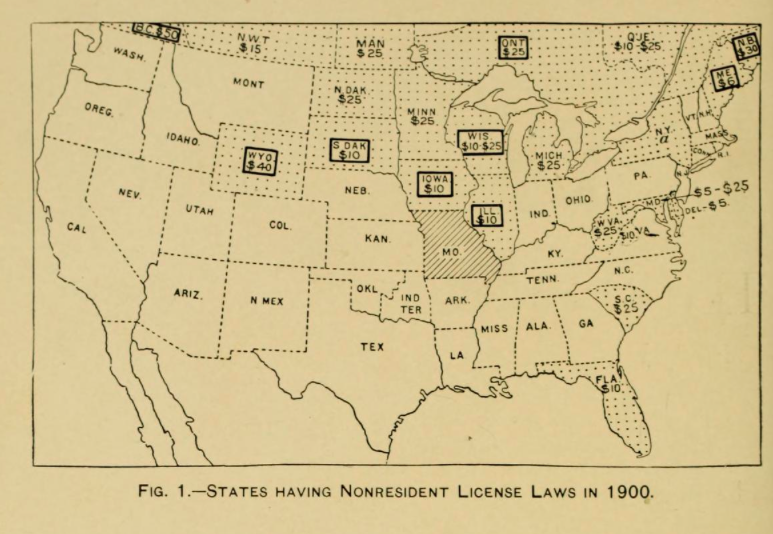
Hunting license sales have dropped in recent years, which portray an overall declining trend in hunting participation. Hunting licenses are very important as 100% of revenue garnered from licenses is used to support wildlife and conservation efforts. With decreasing license sales and less conservation funding, conservation programs will continue to face cut-backs, hurting both wildlife and hunters alike. By examining the causes of declining hunter numbers, and focusing on hunter recruitment and retention, the current national trend can be further understood and addressed. This literature review will include a brief history of hunting licenses, an examination of current hunting license trends, an explanation of the measures that should be taken in order to improve hunting license sales, and an analysis of the economic theory behind the demand for hunting licenses.

History of Hunting Licenses

A hunting license is a legal mechanism used to regulate recreational hunting (Palmer, 1904). Hunting licenses today are used to protect wildlife, increase tax revenue, and dedicate funds towards conservation efforts (Brown & Connelly, 2004; Derichs, 2014). However, the original purpose of hunting licenses was not to benefit wildlife, but rather to discriminate against non-residents within states (Palmer, 1904; Hobson, 2015). Restrictions on hunting began as early as in 1066, where King William the Conqueror in England established forest law to protect prized game and earn revenue by granting local nobles rights to hunt on and exploit royal forests for a fee (Grant, 1991). These fees became a large source of revenue for the monarchy, and the hunting restrictions effectively protected the forests and wildlife for centuries to come (Palmer, 1904). Later, hunting licensing was developed in colonial America, where colonies were determined to preserve their land and all wildlife, and enacted hunting laws to protect their property. Palmer (1904) asserts that early forms of licenses were present as early as 1719, where New Jersey passed a bill prohibiting any non-residents from harvesting oysters within the state. Correspondingly, in 1745, North Carolina enacted a game law stating that non-residents were obligated to possess a certificate showing that they tended 5000 corn hills in the previous season in the county that they wanted to hunt in (Palmer, 1904). This certificate was essentially an early hunting license. Later, similar non-resident discrimination was evident when in 1840 Virginia outlawed any non-residents from hunting fowl on designated beaches and marshes (Palmer, 1904). Non-resident licensing took a much more standard form when in 1873 New Jersey passed an act requiring non-residents to pay $2 a year for hunting privileges, with many states decreeing similar policies soon afterward (Palmer, 1904). These laws principally served to protect the economic interests of residents.

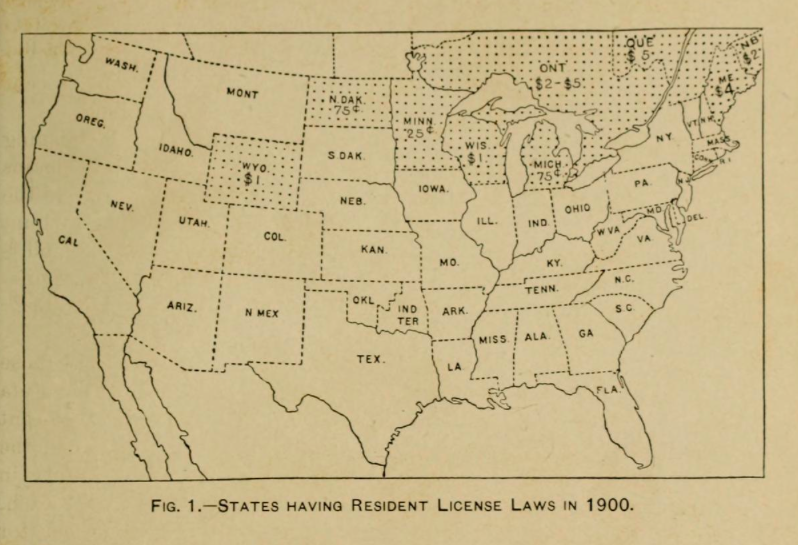
Resident hunting licenses first appeared years later, when in 1895 Michigan restricted deer hunting by stipulating that residents would have to pay 50 cents for hunting rights, while nonresidents would have to pay a lofty $25 (Palmer, 1904). Wisconsin, North Dakota, Maine and Nebraska all drafted resident hunting licenses by the end of the nineteenth century (Palmer, 1904). While initially hunting licenses were exclusively required for harvesting big game such as ungulates and large fowl, by 1900 small game hunting licenses were beginning to appear, effective towards small fowl and rodents (Brown & Connelly, 2004; Hobson, 2015). Throughout history hunting licenses have proved to be effective measures for protecting the privilege of hunting, and eventually garnering revenue to be directed towards conservation efforts (Brown & Connelly, 2004). *Figure 1* illustrates states with nonresident hunting licenses by 1900 along with the price of the licenses while *Figure 2* shows states with resident hunting licenses by 1900 those respective prices.

*Figure 1*. States having nonresident license laws in 1900. Adapted from Hunting Licenses: Their History, Objects, and Limitations



Source: Palmer (1904)

*Figure 2*. States having resident license laws in 1900. Adapted from Hunting Licenses: Their History, Objects, and Limitations



Source: Palmer (1904).

Why Hunting is Declining

A major cause for the nationwide decline in hunting is urbanization which leads to habitat loss. In the last 40 years, the U.S. population has grown by over one hundred million (Baumeister, Cunningham, Gude, & Herbert, 2012; Emmett, 2011). The country’s exponentially increasing population leads to vast losses of wildlife habitat due to growing city suburbs, huge production agricultural expansions, and destructive fossil fuel extractions on land that used to be open for hunting (Hurteau & Love, 2008). Hurteau and Love note that the states that have experienced the greatest drop in hunting license sales are those that have experienced the largest urban growth (2008). Similarly, the overall transition from rural to urban communities has led to a decrease in familial connections to hunting and extensive deterioration in hunting traditions (Ryan & Shaw, 2011). Ryan and Shaw (2011) assert that “conservation programs like the CRP and WRP are being cut back on a national level due to the suburban sprawl, leaving less land available for hunting” (p. 3). At the same time, land conservation programs facing cuts in federal funding, wildlife agencies are being faced with the challenge of competing with private enterprise to obtain land suitable for hunting (Baumeister et al., 2012)

Another root cause for the current decrease in hunting is a loss of time available for hunting. Many adults are working longer hours than they have throughout history, as Baumeister et al. (2012) emphasize a 30% longer work week on average for adults in 2012 compared to in 1972. With less overall leisure time available for many, less time is likely to be allocated towards hunting and other outdoor sports. An increasing lack of prioritization of hunting compared to other pastimes is evident (Ryan & Shaw, 2011). Correspondingly, youth today have a much broader choice of activities to participating than in the past, and combined with the loss of hunting habitat due to urbanization, hunting is less likely to be chosen as a lifelong pastime (Ryan & Shaw, 2011).

Children have very little contact with the outdoors and even less exposure to hunting, as many children prefer playing hunting video games as opposed to actually hunting in real life (Brown & Connelly, 2004; South Carolina DNR, 2007). This fallout in youth hunting is highlighted by a 15% drop in 18-year-and-under hunting license sales over the last two decades (Baumeister et al., 2012). Since hunting is primarily passed down through generations, this trend is likely to continue unless efforts are made to recruit hunters in a broader variety of ways (Ryan & Shaw, 2011).

Hunter Recruitment and Retention

Indicators of hunter recruitment and retention have been nationally observed since 1930. States are required to announce their yearly license sales as a criterion for federal funding within states (South Carolina DNR, 2007). To generate revenue from hunting licenses, there must be a constant stream of buyers. Between 2001 and 2010, hunter numbers fell 4%, reflecting lessening interest and prioritization of hunting compared to other pastimes that people must be participating in (Baumeister et al., 2012; South Carolina DNR, 2007). In order to reverse this trend and increase license sales, wildlife agencies must focus on hunter recruitment and retention.

Hunter Recruitment

Hunter recruitment is defined as the number of novices joining the hunter population. Brown, Decker and Enck (2000) define yearly indicators of hunter recruitment as “the number of first-time participants (e.g., license buyers or graduates from hunter education courses” (p. 817).

Recent trends reflect large decreases in first time license buyers. Age class-data from license sales indicates a drop in hunter recruitment rates of ages 16-26 from 28% to 15% over an eight year period (Brown, Decker, & Enck, 2000). Brown and Connelly (2004) note an 8% decline in first time license buyers. Another index for measuring hunter recruitment is by tracking the number of graduates from hunter education courses. Although Brown, Decker and Enck (2000) indicate that female involvement in hunter education programs has grown from 20% to 30% in the last decade, most courses have recorded a decline in overall hunter education attendance. Similarly, Baumeister et al. (2012) assert that course participation has declined over 3% nationwide from 1985-2005, although some individual states have recorded increases.

Small game hunting in particular has been extensively affected by the nationwide decline in hunting participation. Ryan and Shaw (2011) identify a 12% drop in small game hunting and a 22% in waterfowl hunting over the last 20 years, while Baumeister et al. (2012) note that the average time spent small game hunting has decreased by 40%. These decreases are significant since novice hunters usually exploit small game hunting opportunities rather than big game hunting when beginning the sport. This phenomenon is due in part to cheaper licenses, younger age requirements, greater chances of success, and easier overall difficulty (Baumeister et al., 2012). A lapse in small game hunting participation would dissuade potential hunters from pursuing these opportunities since there would be an insubstantially sized preexisting hunting community for those novices to learn from and participate with. This discrepancy causes a considerable obstacle in hunter recruitment (Baumeister et al., 2012).

The Department of Natural Resources’ Commissioner’s Council on Hunting and Angling Recruitment and Retention (2013) identifies a major cause of the decline in license sales as a notable racial/ethnic challenge that may be negatively impacting recruitment rates in some states. For example, in Minnesota, whites have historically accounted for the majority of hunters, and Hispanics generally have very low participation rates. While the growth rate in the white population in Minnesota is expected to remain constant, the Hispanic population is growing rapidly. This means that the growth rate of the population group that accounts for the majority of license sales is essentially plateauing, while the group that account for hardly any license sales is exploding (offering no help to wildlife agencies that rely on license sales). Minnesota census data notes an 11% decline in population of non-Hispanic Youth, and a 48% increase in Hispanic youth from 2000-2013 (Commissioner’s Council, 2013).

Hunter Retention

Hunter retention is defined as the number of people continuing to be members of the hunter population over time. Retention is an important statistical indicator in the sense that declining retention numbers imply declining interest in hunting, since the hunters have been exposed to and participated in hunting before, and made the decision to either continue or discontinue hunting (i.e. purchasing a license) based presumably on the quality of hunting they experienced (Commissioner’s Council, 2013). Brown et al. (2000) define indicators of hunter retention as “the comparison of the number of participants from year to year, accounting for new recruits and those who cease participation between years” (p. 817). Similarly, another indicator of hunter retention is by measuring the average number of days spent hunting in comparison to participating in other outdoor sports annually (South Carolina DNR, 2007).

According to nationwide data from the National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, the number of license-purchasing hunters increased from 1955 to 1975 by 46%, but declined by upwards of 18% after 1975 (Baumeister et al., 2012). Correspondingly, Brown et al. (2000) assert that “declining trends in mean number of days hunted annually may indicate either decreasing interest or lower prioritization of hunting compared to other activities, portending a sizeable decrease in retention” (819). Presently, retained hunters devote around 17% less time to hunting than hunters did in 1975, 1980, and 1985 (Baumeister et al., 2012). Brown and Connelly (2004) state that people under the age of 25, particularly women, are the least likely demographic to be retained on a yearly basis, despite the fact that this age group makes up the largest population of new hunters annually. This suggests that many of the newly recruited hunters are not being effectively retained nationally, which poses a tremendous threat to license sales and thus revenue to be directed towards conservation projects (Baumeister et al., 2012).

*Figure 3*. Regional changes in hunter numbers between 2001 and 2006. Adapted from “2006 national survey of fishing, hunting, and wildlife-associated recreation”



Source: USFW (2007).

Improving Hunter Recruitment and Retention Rates

Because of the inherent necessity to keep hunter recruitment and retention rates high and constantly increasing, actions must be taken to remedy recent declines. In the 1960s, 10% of Americans ages 16 and older purchased a hunting or fishing license, compared to just 7.8% of that population segment in 2013 (Commissioner’s Council, 2013). Because of low numbers of young people being recruited to hunt annually, parents should expose their children to hunting at a young age, and should provide social support for young hunters in the form of prospective apprenticeships within varying social contexts (Baumeister et al., 2012; South Carolina DNR, 2007).

It has been recommended that mentoring programs be enacted by veteran hunters in order to provide social support and skill development of young hunters (Ryan & Shaw, 2011). Also, due to rising numbers of racial/cultural groups in some states who do not historically have long-standing hunting traditions, actions must be taken by wildlife agencies in order to expand the sport’s cultural reach while simultaneously better understanding and acclimating to the racial/cultural challenges (Commissioner’s Council, 2013). By appealing to a larger variety of demographics, wildlife agencies can widen the pool of prospective hunters they reach, and thus raise hunter recruitment (Ryan & Shaw, 2011). Finally, more vigor needs to be directed towards hunter recruitment and retention efforts on the state level. The Commissioner’s Council on Hunting and Angling Recruitment and Retention (2013) recommends statewide youth sporting clubs, workshops and online resources that familiarize newcomers with the sport, and revisions of hunting licenses to better target families be enacted in order to reverse recent declining participation trends.

Elasticity of Demand of Hunting Licenses

Economics Online (2015) asserts that price elasticity of demand is a measurement to show “the relationship between price and quantity demanded and provides a precise calculation of the effect of a change in price on quantity demanded” (para. 1). Price elasticity of demand is calculated by dividing the percent change in quantity demanded (usually in sales) by the percent change in price. The number the calculation yields is assumed negative since price and revenue are typically inversely related, as would be expected from a price/demand relationship (Economics Online, 2015). If the price demand of elasticity value, in absolute terms, is less than one, the relationship is referred to as inelastic, indicating a weak relationship between price and demand. Conversely, if the value is greater than one, the relationship is referred to as elastic, indicating a strong relationship between price and demand (Economics Online, 2015). Most typical consumer goods are found to be very elastic, since the demand for the goods is greatly influenced by price because there are competitors who keep the price in check by presenting an alternate, and often cheaper, option for the same product (Poudyal, Cho, & Bowker, 2008).

However, hunting licenses differ economically in this context, since they have typically been found to be inelastic (Poudyal, Cho, & Bowker, 2008; Brown & Connelly, 2004). The general inelastic price elasticity of demand found for hunting licenses is caused by the lack of “competitors”; that is, there is only one uniformly priced license per state, and most states have similar license prices. Hunters typically accept the price of the license since they realize that they have no other option but to purchase a license if they want to hunt. The revenue collected from the licenses goes toward conservation purposes in order to better hunting conditions and protect wildlife. State legislative bodies regulate hunting licenses to ensure that agencies are not trying to gouge hunters by imposing unfairly high license prices (Poudyal, Cho, & Bowker, 2008).

The demand of hunting licenses has been typically found to be more elastic towards demographic factors like gender, age and race than towards the price of the license (Poudyal, Cho, & Bowker, 2008). The lack of elasticity towards license fees could be due to the relative inexpensive nature of a hunting license in comparison to all other hunting related expenses, such as gear and travel costs (Brown & Connelly, 2004). The inelasticity could also be caused by the fact that license fees are relatively similar in most geographical areas, thus dispelling the applicability of area-based license price competition (Poudyal, Cho, & Bowker, 2008). Coorespondingly, Poudyal, Cho, and Bowker (2008) identify a price demand of elastic value of 0.8, in absolute terms, denoting a solid inelastic relationship between price and licenses sold. This estimate implies that increasing license prices would not markedly affect the total number of licenses sold, and the estimate implies that increasing license prices would be an effective method for raising license revenue (Poudyal, Cho, & Bowker, 2008; Brown & Connelly, 2004).

However, it is often difficult for wildlife agencies to make any sort of change to hunting license prices. Wildlife agencies must propose potential license structure changes to the state house of representatives, and the state house must further pass a bill allowing the license price change to take place (Baumeister et al., 2012). This limitation sometimes serves as a roadblock toward revenue maximization, as states can have separate agendas from wildlife agencies toward license prices from a political or legislative standpoint ( Baumeister et al., 2012). Wildlife agencies must work in conjunction with states in order to compromise and meet each others’ needs.

*Figure 4* shows the changes in hunting license sales, population, and hunting licenses sold per capita in the Southeast from 2000 to 2008, and predicts the trends up until 2030. The y-axis represents the price elasticity of demand value.

*Figure 4*. Projected hunting license demand in the Southeast region. Adapted from “Demand for resident hunting in the southeastern United States,”



Source: N. Poudyal, S. Cho & J. Bowker (2008), *Human Dimensions of Wildlife, 13,* p. 169.

Conclusion

Hunter participation is dwindling. Evidence for decreasing interest in the sport is found in a 28% to 15% drop in hunter recruitment rates of ages 16-26 over an eight year period (Brown, Decker, & Enck, 2000), and an 8% decline in first time license buyers (Brown & Connelly, 2004). Hunters are also spending over 17% less time on hunting related activities presently as opposed to from 1975-1985 (Baumeister et al., 2012). Since less people overall are partaking in the sport, less hunting licenses are being sold, thus decreasing funds available for wildlife agencies (Brown & Connelly, 2004). Because of these current revenue issues plaguing wildlife agencies nationwide, effective licensing systems are integral to the success of the sport of hunting altogether. Similarly, wildlife agencies must focus on hunter recruitment and retainment in order to ensure hunter participation and license sales.

By analyzing the price elasticity of demand of hunting licenses, the extent to which increasing licenses prices will affect revenue can be accurately predicted (Poudyal, Cho, & Bowker, 2008). With this information in hand, it can be deduced whether or not raising license prices would be an effective measure for aiding the revenue problem and raising funds in order to mutually benefit hunters, wildlife, and wildlife agencies alike. Taken as a whole, hunting licenses are a time-tested, valuable method of protecting wildlife and raising revenue, and must be fully exploited to address the current lapse in hunter participation and the revenue issues that have followed.

Chapter III: Methods

This research focused on the relationship between hunting license prices and their effect on hunting revenue. Through the statistical analysis of hunting license sales data from 2014, the governing question of: how does increasing hunting license prices affect license sales and revenue, was answered. Quantitative data was collected for the statistical analysis, which consisted of gathering data points from various years and used concrete regressions formulas to identify trends. Data is in the form of both nonresident and resident hunting license sales data points from the year 2014, identifying the price of license and the number of licenses sold in various states. Data was then further grouped into different categories and analyzed based on trends found through the regression formulas.

By analyzing the trends hunting license prices have on sales, one can evaluate the implications of raising and lowering hunting license prices to maximize revenue. Poudyal, Cho, and Bowker (2008) assert that calculating price elasticity of demand values is an effective method for deducing the effect of price on revenue. Furthermore, demographic data was used to analyze which demographics are most responsive to license price increases.

Procedures

The researcher gathered state by state resident and nonresident license sale data from the year 2013. Next, the researcher created separate spreadsheets for both nonresident and resident gathered data while simultaneously identifying criteria such as total sales, and sales within specific ages, socioeconomic levels, and educational backgrounds. These specific criteria were selected and identified based on their availability from gathered license data. The researcher then ran regression-type analyses, statistical processes for estimating the relationships among variables, on each separate identified criteria, both nonresident and resident, to identify the price elasticity of demand for each separate group. These analyses elucidated how the amount of revenue changes when any one of the selected independent variables is varied while the other independent variables remain unaltered. Finally, the researcher ran a regression analysis on hunting licenses on a whole, without isolating any variables or criteria, to analyze the overall price elasticity of demand for hunting licenses.

Evaluation

The data was judged as a success since the researcher was able to come up with a feasible, effective plan to help remedy the revenue issue based on the factors assessed, and could be used for policy prescriptions to increase hunting and conservation efforts. The data was proven valid since the effect of increasing hunting licenses on revenue can be accurately predicted based on the model constructed. The data answered the governing question since by calculating the price elasticity of demand value for various demographics and other criteria the researcher was able to deduce the extent to which increasing license prices will affect license revenue as a whole and within different groups.

Conclusion

The data justified the conclusion that raising license prices will not hurt license sales, and that raising license prices would be an effective method of increasing license revenue. Since the researcher’s data suggested a negative price elasticity of demand value, the hypothesis that increasing hunting license prices will not adversely affect license sales and will aid revenue was confirmed.

# Chapter IV: Data

All economic goods have a price elasticity of demand value between -1 and 1, expressed as a decimal. This value is used to measure and portray the responsiveness of the quantity demanded of a good to a change in its price. Thus, by calculating the price elasticity of demand of hunting licenses, the effect license price has on license sales and revenue can be fully understood. Furthermore, by individually calculating the price elasticity of demand values for hunting licenses within the groupings of resident and non-resident, the distinctly different economic trends present for these separate entities become apparent. With this knowledge in hand, the research question of how increasing license price would affect license sales can be answered, since elasticity is essentially a tool used to quantify this relationship.

## Elasticity of Resident Hunting Licenses

**Price Elasticity of Demand of Resident Hunting Licenses**

The price elasticity of demand of resident hunting licenses was calculated to be -0.0878. This decimal’s close proximity to 0 indicates a very weak and thus inelastic relationship between the price of a resident hunting license and the number of resident hunting licenses sold. Although the fact that the price elasticity of demand value is negative implies that increasing license price does have an adverse effect on license sales; this connection is rendered negligible when the sheer weakness of the relationship is accounted for. Intuitively, the coefficient can be interpreted so that an approximate nine percent increase in the price of hunting licenses leads to a one percent decrease in the demand of hunting licenses.

Additionally, the adjusted R-squared value is 0.83, which implies that the specification of independent variables explains 83% of the variation in the dependent variable in this model. R-squared is a statistical measure that indicates how close the data are to the fitted regression line, so a calculated value of 0.83 indicates a good fit.

### Elasticity of Other Criteria Related to Resident Hunting Licenses

Many other criteria were isolated and performed elasticity calculations on in order to deduce their influence on resident hunting license sales. Of these variables, only the states’ total population and the states’ amount of non-resident hunting licenses sales were calculated to be statistically significant in explaining the number of residential licenses purchased in 2013. Although many other variables were found to be not statistically significant, their estimated coefficients are consistent with the inelastic nature of hunting licenses

The individual elasticity of a state’s population was found to be 0.4014. This value can be understood as, a forty percent increase in the population of a state raises the demand for resident hunting licenses by an average of one percent. This calculated trend is consistent with economic theory, since a larger population would beget more consumers of which could potentially purchase a hunting license.

The elasticity of a state’s non-resident hunting license sales when compared to the state’s resident hunting license sales was found to be 1.0565. This relationship indicates more of a correlation rather than causation, signifying that the relationship between the demand for residential and non-residential hunting licenses is weak but positively correlated.

*Figure 5* expresses the relationship between price and number sold of resident hunting licenses. Each blue marking represents a different state, and the flat exponential regression present in the middle of the figure denotes the very weak, negative relationship between license price and license sales

*Figure 6* portrays the statistical significance and calculated elasticity coefficients of various criteria as they relate to resident hunting licenses. A statistically insignificant variable implies that the isolated variable does not hold a clear effect on the dependent variable.

*Figure 5*. Price and Number Sold of Resident Hunting Licenses per State in 2013.

*Figure 6*. Elasticity of Various Criteria Relating to the Demand of Resident Hunting Licenses.

|  |  |  |
| --- | --- | --- |
| Criteria | Elasticity Coefficient | Statistical  Significance |
| Resident Hunting License Price | -0.0878 | No |
| Household Median Income | 0.6361 | No |
| Total State Population | 0.4014 | Yes |
| Non-Resident Hunting Licenses Sold | 1.0565 | Yes |
| Non-Resident Hunting License Price | -0.0169 | No |
| Ages 25-34 With at Least an Associate’s Degree | -0.3584 | No |
| Total Area of State | 0.0709 | No |
| State Population Who Live in Urban Areas | 0.3992 | No |

## Elasticity of Non-Resident Hunting Licenses

The price elasticity of demand of non-resident hunting licenses was calculated to be .1018. This decimal indicates a weak and thus inelastic relationship between the price of a non-resident hunting licenses and the number of resident hunting licenses sold, although this relationship is slightly stronger than that of resident hunting licenses. Conversely, the price elasticity of demand value is positive in this case, which implies that as hunting license price increases, the number of licenses sold does as well. The coefficient can be interpreted as such that an approximate ten percent increase in the price of non-resident hunting licenses leads to a one percent increase in the demand of hunting licenses.

The adjusted R-squared value is 0.84, which implies that the specification of independent variables explains 84% of the variation in the dependent variable in this model, further indicating a good model fit.

### Elasticity of Other Criteria Related to Non-Resident Hunting Licenses

In concordance with the calculations performed on resident hunting licenses, many other criteria were isolated and performed elasticity calculations on in order to deduce their influence on non-resident hunting license sales. However, only the states’ amount of resident hunting licenses sales were found to be statistically significant in explaining the number of residential licenses purchased in 2013. Although many other variables were found to be not statistically significant, their estimated coefficients are consistent with the inelastic nature of hunting licenses.

Although not statistically significant, the elasticity coefficient of the percentage of a state’s population ages 25-34 whom have completed at least an associate’s degree was calculated to be negative. This suggests the trend that a more educated individual would be less likely to purchase a non-resident hunting license.

*Figure 7* expresses the relationship between price and number sold of non-resident hunting licenses. Each purple marking represents a different state, and the slightly flat but increasing exponential regression present in the middle of the figure denotes the slightly weak and positive relationship between license price and license sales

*Figure 8* portrays the statistical significance and calculated elasticity coefficients of various criteria as they relate to non-resident hunting licenses. A statistically insignificant variable implies that the isolated variable does not hold a clear effect on the dependent variable.

*Figure 7*. Price and Number Sold of Non-Resident Hunting Licenses per State in 2013.

*Figure 8*. Elasticity of Various Criteria Relating to the Demand of Resident Hunting Licenses.

|  |  |  |
| --- | --- | --- |
| Criteria | Elasticity Coefficient | Statistical Significance |
| Non-Resident Hunting License Price | 0.1018 | No |
| Household Median Income | -1.0155 | No |
| Total State Population | 0.6926 | No |
| Resident Hunting Licenses Sold | 0.7514 | Yes |
| Resident Hunting License Price | 0.0789 | No |
| Ages 25-34 With at Least an Associate’s Degree | -14.8093 | No |
| Total Area of State | 0.0693 | No |
| State Population Who Live in Urban Areas | -0.6839 | No |

# Chapter V: Discussion

In order to be able to maximize the effectiveness of current hunting licensing procedures, the economics behind licenses must be understood. A close look at the relationship between hunting license price and the number of hunting licenses sold on a state by state basis reveals significant underlying trends. Through various statistical regressions, it was calculated that resident hunting licenses are relatively inelastic economic goods, meaning that the number of licenses purchased is not sensitive to the price of licenses. Similarly, nonresident hunting licenses are inherently relatively inelastic, meaning like resident hunting licenses, license price does not carry measurable influence on the number of nonresident licenses sold.

## Discussion and Implications of Resident Hunting Licenses’ Elasticity

Resident hunting licenses were defined as relatively inelastic economic goods. Thus, as would be true with all inelastic goods, altering the price of resident hunting licenses yields no measurable effect on the number of resident hunting licenses sold. This phenomenon could be due to the fact thatmost resident hunters are often quite ingrained in the pastime and would not be easily dissuaded solely due to license price, as hunting is usually an activity passed down through the family generationally. Similarly, resident hunters cannot simply move to another lower-priced state in order to "evade" a high license price, and are hence likely to accept any license fees, regardless of their expensiveness. Finally, hunters tend to be aware of the fact that funds gathered from hunting licenses goes toward wildlife conservation. Since more money towards conservation mutually benefits both hunters and wildlife agencies, hunters usually hold no qualms towards the nominal required fee.

This information is especially significant to wildlife agencies, since 100% of funds gathered from the sale of hunting licenses goes directly toward conservation efforts. Policymakers could take advantage of this relationship to slightly raise the price of resident hunting licenses (producing no decrease in license sales) to in turn create more overall revenue for wildlife agencies, and consequently create more money to be used for conservation.

## Discussion and Implications of Non-Resident Hunting Licenses’ Elasticity

Non-resident hunting licenses were also defined as relative inelastic. This inelastic relationship between license price and the amount of licenses demanded means that, for nonresident licenses, the cost of the license has no measurable impact on the number of licenses sold.

Interestingly, the price elasticity of demand coefficient was found to be positive, suggesting that higher license prices are more often demanded. Although not statistically significant, this trend could be correlated with the fact that states where hunting is the best and thus most popular often have very high non-resident license prices. These states with very high non-resident license prices, such as Alaska, Wyoming, Montana, and Colorado, attract huge numbers of out-of-state hunters annually because they are extremely attractive hunting destinations. These states’ policymakers might even realize that a high license price will not deter non-resident hunters, and elect to keep their license prices high in turn.

The information would suggest to wildlife agencies that increasing nonresident hunting license prices would be an effective way to maximize revenue. Policymakers would be very intuitive to increase non-resident hunting license prices within certain states, in the interest of taking full advantage of license revenue for wildlife agencies. This is not to say that a small nonresident license price increase would not be practical within all states, but rather that the trend could be applied within a state-by-state context.

## Significance

Wildlife agencies have recently faced a major decrease in revenue, as there has been a steep decline in hunting over the last decade. This trend makes it very difficult for agencies to carry out their many responsibilities. As such, many conservation-related activities that agencies were previously able to fund have halted as a result of the shortage. This enigma not only directly affects conservationists, but hunters as well. With less conservation efforts being funded, there is a lower overall quality of hunting, as money used towards conservation creates dedicated wildlife areas, protects wildlife populations, and addresses localized wildlife health issues. Thus, it is in the best interest of both hunters and conservationists to do whatever it takes to address the current revenue shortage.

It was calculated that a small hunting license price increase would increase revenue for resident and nonresident licenses. The extra revenue generated from this nominal change would go directly towards conservation, helping to create healthier wildlife populations, and therefore improve hunting conditions. Improved hunting conditions would entice more potential hunting license buyers to purchase a hunting license, generating even more revenue to be used toward conservation. Perhaps even a self-sustaining cycle would be created, reversing the sharp decline in hunting and conservation funds, where hunters and conservationists could mutually benefit.

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# Appendix

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| state | res\_price | res\_#sold | ln\_price | ln\_sold | nonres\_price | nonres\_#sold | ln\_price | ln\_sold |  |  |  |  |  |  |  |  |  |
| AK | 25 | 101547 | 3.218876 | 11.52828 | 85 | 12721 | 4.442651 | 9.45100945 |  |  |  |  |  |  |  |  |  |
| AL | 25.75 | 530127 | 3.248435 | 13.18087 | 301.35 | 31344 | 5.708272 | 10.35277814 |  |  |  |  |  |  |  |  |  |
| AR | 25 | 390554 | 3.218876 | 12.87532 | 350 | 80182 | 5.857933 | 11.29205433 |  |  |  |  |  |  |  |  |  |
| AZ | 37 | 195664 | 3.610918 | 12.18415 | 160 | 15447 | 5.075174 | 9.645170089 |  |  |  |  |  |  |  |  |  |
| CA | 47.01 | 281472 | 3.85036 | 12.54779 | 163.65 | 5753 | 5.09773 | 8.657476737 |  |  |  |  |  |  |  |  |  |
| CO | 31 | 286363 | 3.433987 | 12.56502 | 371 | 60804 | 5.916202 | 11.01541086 |  |  |  |  |  |  |  |  |  |
| CT | 19 | 44178 | 2.944439 | 10.69598 | 68 | 1598 | 4.219508 | 7.376508126 |  |  |  |  |  |  |  |  |  |
| DE | 25 | 18184 | 3.218876 | 9.808297 | 130 | 2261 | 4.867534 | 7.723562472 |  |  |  |  |  |  |  |  |  |
| FL | 17 | 176616 | 2.833213 | 12.08173 | 151.5 | 7025 | 5.020586 | 8.857230494 |  |  |  |  |  |  |  |  |  |
| GA | 10 | 363575 | 2.302585 | 12.80374 | 195 | 37002 | 5.273 | 10.51872724 |  |  |  |  |  |  |  |  |  |
| HI | 10 | 9815 | 2.302585 | 9.191667 | 95 | 503 | 4.553877 | 6.22059017 |  |  |  |  |  |  |  |  |  |
| IA | 19 | 227408 | 2.944439 | 12.3345 | 112 | 20599 | 4.718499 | 9.93299781 |  |  |  |  |  |  |  |  |  |
| ID | 12.75 | 248728 | 2.545531 | 12.42412 | 154.75 | 25742 | 5.041811 | 10.15587918 |  |  |  |  |  |  |  |  |  |
| IL | 12.5 | 321739 | 2.525729 | 12.6815 | 57.75 | 30144 | 4.056123 | 10.31374118 |  |  |  |  |  |  |  |  |  |
| IN | 15 | 273929 | 2.70805 | 12.52062 | 80 | 11399 | 4.382027 | 9.341280911 |  |  |  |  |  |  |  |  |  |
| KS | 20.5 | 226553 | 3.020425 | 12.33073 | 72.5 | 71568 | 4.283587 | 11.17840333 |  |  |  |  |  |  |  |  |  |
| KY | 20 | 330238 | 2.995732 | 12.70757 | 140 | 46405 | 4.941642 | 10.74516249 |  |  |  |  |  |  |  |  |  |
| LA | 15 | 345525 | 2.70805 | 12.75282 | 150 | 23720 | 5.010635 | 10.07407385 |  |  |  |  |  |  |  |  |  |
| MA | 27.5 | 57641 | 3.314186 | 10.96199 | 99.5 | 3739 | 4.600158 | 8.226573475 |  |  |  |  |  |  |  |  |  |
| MD | 24.5 | 120321 | 3.198673 | 11.69792 | 130 | 20033 | 4.867534 | 9.905136193 |  |  |  |  |  |  |  |  |  |
| ME | 25 | 189120 | 3.218876 | 12.15014 | 114 | 26735 | 4.736198 | 10.19372885 |  |  |  |  |  |  |  |  |  |
| MI | 11 | 761269 | 2.397895 | 13.54274 | 151 | 14123 | 5.01728 | 9.555559953 |  |  |  |  |  |  |  |  |  |
| MN | 38 | 579910 | 3.637586 | 13.27063 | 165 | 13450 | 5.105945 | 9.506734385 |  |  |  |  |  |  |  |  |  |
| MO | 17 | 486608 | 2.833213 | 13.09521 | 225 | 19128 | 5.4161 | 9.858908509 |  |  |  |  |  |  |  |  |  |
| MS | 17 | 220266 | 2.833213 | 12.30259 | 300 | 43837 | 5.703782 | 10.68823349 |  |  |  |  |  |  |  |  |  |
| MT | 16 | 235621 | 2.772589 | 12.36998 | 592 | 32181 | 6.383507 | 10.3791315 |  |  |  |  |  |  |  |  |  |
| NC | 20 | 521717 | 2.995732 | 13.16488 | 80 | 50989 | 4.382027 | 10.8393652 |  |  |  |  |  |  |  |  |  |
| ND | 30 | 156052 | 3.401197 | 11.95794 | 277 | 42367 | 5.624018 | 10.65412504 |  |  |  |  |  |  |  |  |  |
| NE | 14 | 177623 | 2.639057 | 12.08742 | 81 | 19463 | 4.394449 | 9.876270506 |  |  |  |  |  |  |  |  |  |
| NH | 22 | 59301 | 3.091042 | 10.99038 | 103 | 8647 | 4.634729 | 9.064967719 |  |  |  |  |  |  |  |  |  |
| NJ | 27.5 | 77607 | 3.314186 | 11.25941 | 135.5 | 16514 | 4.908972 | 9.711963785 |  |  |  |  |  |  |  |  |  |
| NM | 15 | 97893 | 2.70805 | 11.49163 | 65 | 1685 | 4.174387 | 7.429520843 |  |  |  |  |  |  |  |  |  |
| NV | 33 | 64334 | 3.496508 | 11.07184 | 142 | 11385 | 4.955827 | 9.340051978 |  |  |  |  |  |  |  |  |  |
| NY | 22 | 581401 | 3.091042 | 13.2732 | 100 | 29902 | 4.60517 | 10.30568065 |  |  |  |  |  |  |  |  |  |
| OH | 19 | 405866 | 2.944439 | 12.91378 | 125 | 37146 | 4.828314 | 10.52261137 |  |  |  |  |  |  |  |  |  |
| OK | 25 | 381049 | 3.218876 | 12.85068 | 176 | 25307 | 5.170484 | 10.13883632 |  |  |  |  |  |  |  |  |  |
| OR | 47.01 | 260949 | 3.85036 | 12.47208 | 148.5 | 9987 | 5.000585 | 9.209039526 |  |  |  |  |  |  |  |  |  |
| PA | 20.7 | 968735 | 3.030134 | 13.78375 | 101.7 | 39228 | 4.622027 | 10.57714606 |  |  |  |  |  |  |  |  |  |
| RI | 18 | 8605 | 2.890372 | 9.060099 | 45 | 1405 | 3.806662 | 7.247792582 |  |  |  |  |  |  |  |  |  |
| SC | 12 | 173942 | 2.484907 | 12.06648 | 125 | 25861 | 4.828314 | 10.16049132 |  |  |  |  |  |  |  |  |  |
| SD | 35 | 235512 | 3.555348 | 12.36952 | 121 | 86641 | 4.795791 | 11.36952842 |  |  |  |  |  |  |  |  |  |
| TN | 34 | 530547 | 3.526361 | 13.18166 | 305 | 28863 | 5.720312 | 10.27031578 |  |  |  |  |  |  |  |  |  |
| TX | 25 | 1036946 | 3.218876 | 13.85179 | 315 | 50970 | 5.752573 | 10.8389925 |  |  |  |  |  |  |  |  |  |
| UT | 34 | 211863 | 3.526361 | 12.2637 | 268 | 20544 | 5.590987 | 9.930324206 |  |  |  |  |  |  |  |  |  |
| VA | 16 | 300764 | 2.772589 | 12.61408 | 111 | 17351 | 4.70953 | 9.761405421 |  |  |  |  |  |  |  |  |  |
| VT | 25 | 80650 | 3.218876 | 11.29787 | 100 | 8443 | 4.60517 | 9.041092975 |  |  |  |  |  |  |  |  |  |
| WA | 44.9 | 188081 | 3.804438 | 12.14463 | 434.3 | 2352 | 6.073736 | 7.763021309 |  |  |  |  |  |  |  |  |  |
| WI | 24 | 704357 | 3.178054 | 13.46504 | 160 | 34888 | 5.075174 | 10.45989821 |  |  |  |  |  |  |  |  |  |
| WV | 19 | 221806 | 2.944439 | 12.30956 | 119 | 46122 | 4.779123 | 10.73904534 |  |  |  |  |  |  |  |  |  |
| WY | 38 | 143155 | 3.637586 | 11.87168 | 312 | 51886 | 5.743003 | 10.85680428 |  |  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | *Coefficient* | *Standard Error* | *LCL* | *UCL* | *t Stat* | *p-level* | *H0 (5%)* |
| **Intercept** | 43.03199 | 76.91139 | -112.2971 | 198.35768 | 0.5595 | 0.57886 | *accepted* |
| **ln\_price** | 0.10182 | 0.23317 | -0.36907 | 0.57271 | 0.4367 | 0.66462 | *accepted* |
| **ln\_income** | -1.01554 | 0.9307 | -2.89513 | 0.86404 | -1.09116 | 0.28157 | *accepted* |
| **ln\_pop** | 0.6926 | 2.87493 | -5.11344 | 6.49863 | 0.24091 | 0.81083 | *accepted* |
| **ln\_edu** | -14.80932 | 43.45787 | -102.57427 | 72.95563 | -0.34077 | 0.73501 | *accepted* |
| **ln\_res\_sold** | 0.7514 | 0.06079 | 0.62863 | 0.87417 | 12.35998 | 0. | *rejected* |
| **ln\_res\_price** | 0.07897 | 0.32392 | -0.5752 | 0.73313 | 0.24379 | 0.80861 | *accepted* |
| **ln\_area** | 0.06938 | 0.12345 | -0.17993 | 0.31869 | 0.562 | 0.57718 | *accepted* |
| **ln\_urban** | -0.68394 | 0.67356 | -2.04422 | 0.67633 | -1.01542 | 0.31586 | *accepted* |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | *Coefficient* | *Standard Error* | *LCL* | *UCL* | *t Stat* | *p-level* | *H0 (5%)* |
| **Intercept** | -11.32953 | 14.00466 | -39.61252 | 16.95346 | -0.80898 | 0.42319 | *accepted* |
| **ln\_price** | -0.08785 | 0.38307 | -0.86146 | 0.68577 | -0.22933 | 0.81976 | *accepted* |
| **ln\_income** | 0.63616 | 1.57506 | -2.54475 | 3.81707 | 0.40389 | 0.68839 | *accepted* |
| **ln\_pop** | 0.40143 | 0.16394 | 0.07034 | 0.73252 | 2.44862 | 0.01871 | *rejected* |
| **ln\_nr\_sold** | 1.05653 | 0.08928 | 0.87622 | 1.23683 | 11.83389 | 0. | *rejected* |
| **ln\_nr\_price** | -0.16933 | 0.27513 | -0.72495 | 0.3863 | -0.61545 | 0.54166 | *accepted* |
| **ln\_edu** | -0.35844 | 1.23412 | -2.8508 | 2.13393 | -0.29044 | 0.77295 | *accepted* |
| **ln\_area** | 0.07096 | 0.15518 | -0.24242 | 0.38435 | 0.4573 | 0.64987 | *accepted* |
| **ln\_urban** | 0.39925 | 0.80504 | -1.22655 | 2.02505 | 0.49594 | 0.62259 | *accepted* |